Unit-I.st - Part-I (WSM)

Short Question Bank:-

1. What is modular ratio? Determine the modular ratio of M_{20} grade concrete.
2. Define characteristic strength.
3. Define limit state of serviceability.
4. What is meant by segregation and Bleeding of concrete? under what circumstances, they take place.
5. Explain the following terms
   - (a) Balanced section
   - (b) under reinforced section
   - (c) over-reinforced section
6. What are various design philosophies? Explain any one of these in detail.
7. under what circumstances a doubly reinforced beam is designed.
8. Define the type of section of a rectangular Beam section to carry 160 KN-M with M_{20} concrete and Fe-415 steel

Long Question Banks:

1. Define Design philopophies and explain in the details.
2. Design the section of a doubly reinforced beam to resist a building bending moment of 185 KN-M. The section of the beam is restricted to 350MM X 700MM. Assume effective cover 50MM. use M20 grade of concrete and Fe415 steel.
3. Design a reinforced concrete beam subjected to a B.M. of 90KN-M. use M20 concrete Fe415 reinforcement keep the width of the beam equal to the half of effective depth.
4. Design a rectangular beam section to carry 160 KN-M moment with M-20 concrete and Fe415 steel. The over all depth of the beam is restricted to 270MM.
5. A beam section 230MM X 300 MM effective depth is reinforcedwith 2 bars of 12 MM dia.. Determine its moment capacity and stresses developed in concrete and steel used. used concrete is M-20 and steel Fe-415.

WSM

(1) What is R.C.C.? Why do we reinforce plain concrete?

(2) Write short notes on the following
   a) Working stress method
   b) Limit state method

(3) Compare deformed and plain bars.?

(4) Explain what is nominal mix & design mix concrete? Explain various steps of mix design.

(5) State the assumptions made in the theory of elastic bending.

(6) What do you understand by balanced section.

(7) What is a doubly reinforced beam and why it is provided.?

(8) What is modular ratio? What is its significance in design?.

(9) Determine the values of design constant (J, k, Q) and percentage of balanced steel for a beam of dimension, b and d. Use M25 and Fe415 steel.

(10) Find the MOR of an R.C.C beam 350MM X 550MM (effective) & is reinforced with 3 bars of 20MM diameter. Use M20 concrete and Fe415 steel. Take $m = 13.33$ Also Comment on the type of beam section.

(11) An RCC beam 300MM wide and 550MM deep (effective) is reinforced with 4 bars of 25 MM dia. Determine the stresses in concrete and steel of the beam is subjected to a bending moment of 140 KNM. Take $m = 13.33$.

P.T.O.

(12) An RCC beam 300mm x 600mm deep (effective) is provided with tensile and compressive steel of 1256mm² each. The reinforcement on the compression side is placed 40mm from top edge of the beam. Find the moment of resistance of the section using
1) Elastic theory.

(13) A doubly reinforced concrete beam is 400mm wide and 600mm deep to the centre of tensile reinforcement. The compression reinforcement consist of 4-16mm diameter bars and tensile reinforcement consist of 4-20mm ϕ bars. The beam section is subjected to a bending moment of 150 kN-m. Determine the stresses developed in steel and concrete. Take $m=16$ $d_c=40$mm.

(14) Design the section of a doubly reinforced beam to resist a bending moment of 185000 N-m. The section of the beam is restricted to 350 x 700mm. Assume 50mm effective cover and M20 and mild steel is used.

(15) Determine the effective depth required by an RCC beam to resist a bending moment of 20 kNm. Also determine the area of tensile reinforcement needed. Take $b=\frac{d}{2}$. Use M20 concrete & Fe415 steel.

Unit-I (SI) – Part-II (LSM)

Short Question Bank:-

1. Define limit state method.
2. Define limit state of serviceability.
3. Define factor of safety and load factor.
4. Discuss different limit state to be considered in reinforced concrete design.
5. Write Assumption in limit state method:

Long Question Bank:

① Analyse a T-beam for the following data
$b_f = 1500$ mm $\quad D_f = 100$ mm, $D = 600$ mm
$b_w = 300$ mm $\quad f_{ck} = 150$ N/mm^2
$f_y = 415$ N/mm^2. A_{st} = 6 bars of 20 mm dia.
with effective cover of 65 mm

② A T-beam floor consists of 150 mm thick R-C slab monolithic with 300 mm wide beams. The beams are spaced at 3.5 m center to center and their effective span is 6 m. If the superimposed load on the slab is 5 kN/m^2. Design an intermediate I beam use M20 & Fe250.

③ A-T beam casted with M-20 & Fe-415 steel. has the following dimensions
width of flange = 2400 mm
depth of flange = 100 mm
width of web = 250 mm
overall depth of beam = 450 mm
effective cover to rei = 50 mm
tension reinforcement = 2 bars of 16 mm dia.

④ A rectangular beam 200 mm wide and 400 mm eff. depth is reinforced with 3 bars of 16 mm dia. of the grade of concrete is M-20 and grade of steel Fe 415. determine the bending moment capacity.

LSM:

1. Explain the limit state method of design.
2. What are the different types of limit state of design?
3. Define the following terms?
   i) Limit state
   ii) Factored load
   iii) characteristic strength
   iv) Design values.
4. Explain the line" limit state method is more rational than working stress method."
5. State the assumptions of limit state of collapse (flexure).
6. Differentiate between balanced, under-reinforced and over reinforced sections.
7. Determine the depth of N.A. for a beam of section 250mm wide and 400mm deep (effective). The beam is reinforced with 3-bars of 20mm diameter. use $f_{ck} = 20 N/mm^2$ & $f_y = 415 N/mm^2$
8. Draw the strain diagram for a rectangular beam section and Calculate the limiting depth of the N.A. for Fe415 steel.
9. An RCC beam 300mm x 500mm effective is carrying a factored moment of 175 kNm. Determine the area of steel required if M20 concrete and Fe 415 steel is used.
10. A singly reinforced simply supported beam 200mm x 500mm (effective) is reinforced with 4 - 25mm diameter bars. Determine the ultimate moment of resistance

of the section. Also calculate the ultimate load the beam can carry over a span of 5 m. use M20 concrete and Fe415 steel.

(11) What are the conditions in which we design a doubly reinforced beam.?

(12) Determine the ultimate MOR of a rectangular beam 300 mm x 600 mm (effective), reinforced with 5-25mm diameter bars in tension zone and 2-25 mm ϕ bars in compression zone. use M20 concrete and Fe415 steel. Take $d_c = 60$ mm.

(13) Determine area of reinforcement require for a

Unit-II Q.B — Behaviour of Beam in Shear

(1) What is the effect of shear? Explain with the help of a diagram.
(2) Define diagonal tension. How can we prevent it.
(3) What are the various forms of shear reinf.?
(4) How can we ↑ the bond between steel and concrete.?
(5) What do you understand by the term development length.?
(6) Write short notes on
   I) Splicing of bars
   II) Curtailment of bars
   III) Bond
   IV) Types of shear reinforcement
(7) What is the necessity of providing shear reinforcement.
(8) An R.C.C beam 250 mm x 500 mm effective is reinforced with 6-20 mm diameter bars. It is carrying a UDL of 120 kN/m (including self wt.) over an effective span of 6 m. Determine the nominal shear stress and comment on its shear design. Use M20 concrete.
(9) Discuss various ways of achieving required bond stress?
(10) An R.C.C beam has an effective depth of 600 mm and a breadth of 300 mm. It is reinforced with 6-25 mm diameter bars. It is carrying a factored shear force of 240 kN. Find whether shear reinforcement is required or not. Use M20 & Fe415

(11) What do you mean by bond & Development length & prove the formula for development length.

$$Ld \geq \frac{0.87 f_y \cdot \phi}{4 \tau_{bd}}$$

(12) What do you mean by flexural bond & how it works.

(13) An R.C.C. beam of 250MM X 500 MM has a clear span of 5.5M. The beam has 2-20MM ϕ bars going into the support. Factored shear force is 140KN. Check for development length if Fe415 and M20 grade of concrete is used.

(14) An R.C.C. beam 250MM X 400 MM effective is carrying a UDL of 16KN/M. The beam is reinforced with 4- bars of 22 MM diameter. The clear span of the beam is 4M. Design the shear reinforcement. Use M20 concrete & plain mild steel bars.

(15) An R.C.C. beam 200MM X 400 MM effective carries a UDL of 70 KN/M over a clear span of 6M. The beam is reinforced with 1% steel on tension side comment on the shear design of the beam. use M20 concrete & load factor = 1.5.

UNIT 3 (SLAB)

1. What is the flat slab? Explain the components of flat slab with neat sketch.
2. Write a note on "opening in flat slab"?
3. How shear to be checked in case of flat slab?
4. How total design moment to be computed in the direct design method and how it is distributed?
5. What are the methods to determine the bending moment in case of the flat slab? Explain any one method in detail?
6. Design the typical interior panel of a flat slab floor of size 5m*5m with suitable drop to support a live load of 4kn/m^2 .The floor is supported by columns of size 450mm*450mm.Use M20 and Fe415.Sketch the reinforcement details by showing cross sections
   I. At column strip
   II. At middle strip
7. A flat slab system consists of 5m*6m panels and is without column head and drop .It has to carry a live load of 4kn/m^2 and a finishing load of 1 KN/m^2.It is to be designed using M20 grade concrete and Fe 415 steel. The size of the column supporting the system is 500mm*500mm and floor to floor height is 4.5 M. Calculate design moments in interior and exterior panels at column and middle strips in both directions.
8. What are moments in interior and exterior panel of a flat slab? (2015-16)
9. Define column head and drop. (2016-17)
10. A slab is supported on 600 mm diameter circular columns spaced 8 m x 6 m apart in both directions. The column head has a diameter of 120 cm. The live load on the flat slab is 5 kN/m^2. Determine the moments in the flat slab along its 8m span. (2016-17)
11. What are the methods of analysis of flat slab? (2015-16)
12. Write a short note on flat slabs. (2015-16)
13. Design the interior panel of a slab with drops for an office floor to suit the following data :

Size of office floor	20m*20m
Size of panels	5m*5m
Loading class	4KN/m^2

    Materials: M20 grade concrete and Fe4l5 HYSD bars. Give a neat reinforcement detail drawing. (2015-16)
14. Design an interior panel of a flat slab with panel size 6m*6m supported by columns of size 500mm*500m.Provide suitable drop .Take live load as 4kN/m^2.Use M20 and Fe415 steel.
15. List a few factors that affect the punching shear strength flat slabs. (2016-17)
16. What is one way slab? Explain the procedure of designing a one way slab.
17. Explain the difference between one way & two way slab.
18. What is cantilever chajja? Give the point to be considerd while designing a cantilever chajja.
19. What is the function of providing distribution steel in a slab.
20. What is continuous slab? How do you design continuous slab by IS code Method.

UNIT-IV Q.B. – COLUMNS

1. What is a column? Give classification of columns.
2. Explain the diff b/w short column & long column.
3. What is the function of transverse reinforcement in a column?
4. What is minimum eccentricity?
5. Why helical ties are preffered over lateral ties?
6. Give the steps to design of a column subjected to axial load and biaxial bending.
7. A short column 400 mm x 400 mm is reinforced with 4-25 mm diameter bars. Find the ultimate load carrying capacity of the column. use M20 & Fe415. Assume $e < 0.05D$.
8. Design a short R.C.C. column 500 mm x 500 mm, to carry a factored load of 1000 kN. Assume $e_{min} < 0.05D$ use M20 & Fe415 steel.
9. Design a column 400 mm x 400 mm for following data:

   $P_u = 2000$ kN
   $M_{ux} = 150$ kNm
   $M_{uy} = 100$ kNm

   unsupported length of column = 4m, effective cover = 50 mm.
   use M20 & Fe415.
10. What are additional secondary moments in slender columns?

(11) What is minimum eccentricity? Give its limiting value for considering a column axially loaded in limit state method of design.

(12) Design a circular column 4m high & effectively held in position and restrained against rotation at both ends. It is carrying a factored load of 1600kN. Use M25 concrete and Fe415 steel.

(13) Design a short circular column 6m long to carry an axial load of 250kN, if both end of the column are fully restrained. use helical reinforcement.

(14) Design a circular column of diameter 400mm subjected to a load of 1200kN. The column is having spiral ties. The column is 3m long and is effectively held in position at both ends but not restrained against rotation. Use M25 concrete & Fe415 steel

(15) Design a column of size 450mm x 600mm and having 3m unsupported length. The column is subjected to a load of 2000kN and is effectively held in position but not restrained against rotation use M30 concrete & Fe415 steel.

Question Bank

UNIT 5 (BEAM CURVED IN PLAN) + Footing

1. What is foundation? Describe the types of foundations.
2. Under what circumstances the beams curved in plan are used?
3. Under what circumstances combined rectangular and trapezoidal footing are used?
4. A 500 mm x 700 mm rectangular ring beam curved in plan is supported on 5 columns located equi-distant on a circle of 9.0 m mean diameter If the service load is 100 kN/m and diameter of columns is 350 mm, design the beam at a support. Use M 20 grade concrete Fe 415 grade steel- The coefficients for maximum positive bending maximum negative bending moment and torsion moment and are 0.033, 0.066 and 0.005. (2013-14)
5. Design a square spread footing to carry an axial load of 1500 kN from a 400 mm square tied column containing 20 mm bars as the main reinforcement. The bearing capacity of soil is 100 kN/m2. Consider base of footing at l.2 m below the ground level. The unit weight of soil is 20 kN/m^3. Use M 20 grade concrete and Fe 415 grade steel. (2013-14)
6. Design a footing for the foundation of brick wall 400 mm thick and transmitting a load of 120 kN/m of its length. The bearing capacity of soil is 65 kN/m^2. The unit weight of earth is 17 kN/m3. Use M 20 grade concrete and Fe 415 grade steel. (2013-14)
7. What are the main requirements of a foundation system for a structure? (2012-13)
8. Why is it desirable to eliminate eccentricity in loading on a footing, wherever possible, by means of proper proportioning? (2012-13)
9. Design a plain concrete footing for a column, 300 mm x 300 mm, carrying an axial load of 330 kN (under service loads, due to dead and live loads), assume an allowable soil bearing pressure of 360 kN/m2 at a depth of 1.0 m below ground. Assume M20 concrete and Fe 415 steel. (2012-13)
10. List the principles in design of strap footing? (2016-17)
11. What are the situations in which combined footings are preferred over isolated footings? (2016-17)
12. Draw a typical reinforcement detail of combined rectangular and trapezoidal footings. (2016-17)
13. Design a combined footing for two columns carrying axial loads of 500 kN and 800 kN. Both columns are 30 cm in diameter and are spaced at 3m centre to cenke. Columns are reinforced with 18 mm bars and consist of M25 Grade. The bearing capacity of the soil is 80 kN/m2.Use M30 & Fe415 grade steel. (2016-17)
14. Design a footing of 250 mm the masonry wall which supports a load of 150 kN /m and Moment of 15 kN m at service state Consider, Unit wt of soil = 20 kN /m3
    Angle of repose = 30^0, Allowable bearing capacity of soil = 150 kN /m2.
    Use M20 andFe415. (2016-17)
15. Design a strap footing for two columns spaced at 6 m c/c face of one of the column of section 400 mm x 400 mm and subjected to a load of 1000 kN at service coincides with the property Line and other column is of section 500 mm x 500 mm and subjected to a load of l500kN at service state. (2016-17)
16. Write down the procedure involved in design of strap footing. (2015-16)

Question Bank.

5

UNIT (RETAINING WALL)

1. Determine the dimensions of a T-shaped retaining wall for a height of 5 m above the ground level. The top of the earth is surcharged at 200 with the horizontal. The angle of repose of earth is 30o and its density is 20 kN/m3. The safe bearing capacity of soil is 90 kN/m2 and coefficient of friction between concrete and soil is 0.55. (2013-14)
2. Design the vertical stem of a T-shaped retaining wall for a height of 3.5 m above the ground level. The top of earth retained is horizontal. The angle of repose of earth is 300 and its density is 20 kN/m3. The safe bearing capacity is 100 kN/m? Use M 25 grade concrete and Fe 415 grade steel. (2013-14)
3. A slab culvert has a span of 4.5 m and a clear roadway between Kerbs is l0 m. Determine the value of maximum bending moment for a single vehicle of IRC Class A or two vehicles of Class A loading. (2013-14)
4. What is the purpose of retaining wall? (2012-13)
5. Design a suitable counter fort retaining wall to support a level backfill, 7.5 m high above the ground level on the toe side. Assume good soil for foundation at a depth of 1.5 m below the ground level with a safe bearing capacity of 170 kN/m2. Further assume the backfill to comprise granular soil with a unit weight of 16 kN/m3 and an angle of shearing resistance of 30o. Also assume the coefficient of friction between soil and concrete to be 0.5. Use M25 grade concrete and Fe 415 grade steel. (2012-13)
6. Briefly describe the behavior of the various elements of a cantilever retaining wall and a counter fort retaining wall. (2012-13)
7. Suggest suitable proportions for a counter fort retaining wall to support difference in ground elevation of 9 m, the foundation depth may be taken as 1.5 m below ground level, with a safe bearing capacity of 160 k}.{/m2. Assume a level backfill with a unit weight of 16 kN/m3 and an angle of shearing. Resistance of 30o. Also assume coefficient of friction, μ= 0.5, between soil and concrete. Check the stability of the wall. (2012-13)
8. Write short notes on segmental retaining walls. (2016-17)
9. What are the two theories for calculating earth pressure on retaining wall? (2016-17)
10. Explain the general features and design principles of counter fort retaining wall. (2016-17)
11. Design a T-shaped cantilever. Retaining wall for retaining 5 m high earth above the ground level. Consider the weight of soil: 15 kN /m3.Angle of repose of soil: 30^0, coefficient friction at of base: 0.5, Allowable bearing pressure of soil: 150 kN /m2. Grade M20 concrete and Fe415 for steel. (2016-17)
12. What are the stability conditions should be checked for the retaining walls? (2015-16)
13. Write down the function ofcounter forts in a retaining wall? (2015-16)
14. Write down the steps involved in design of courter fort retaining wall. (2015-16)