MAULANA ABUL KALAM AZAD UNIVERSITY OF TECHNOLOGY, WEST BENGAL

Paper Code : CE(PC)501 Design of RC Structures

Time Allotted : 3 Hours *Full Marks :70*

The Figures in the margin indicate full marks.
Candidate are required to give their answers in their own words as far as practicable

Group-A (Very Short Answer Type Question)

1. Answer any ten of the following : [1 x 10 = 10]

(i) As per the code IS-456, for controlling the vertical deflection of continuous two-way slabs with Fe415 grade HYSD steel reinforcement bars, the maximum value of the span to overall depth ratio should be .....10.....

(ii) HYSD bars in either direction in RCC slabs should not be less than ------- of total cross-sectional area.

(iii) All RCC columns, as per the code IS-456, shall be designed for minimum eccentricity, equal to the unsupported length of column/500 plus lateral dimension/30, subjected to a minimum eccentricity value of .....16..... mm.

(iv) A square-shaped RCC solid slab, supported only on two opposite edges and unsupported on the remaining two edges, may be considered as .....- way slab.

(v) For a 2 m long cantilever beam with 1% Fe415 re-bars, the ratio of span to effective depth is .....7.....

(vi) The unsupported length between end restraints, as per the code IS-456, should not exceed ..... times the least lateral dimension of a column.

(vii) Wind load for RCC structure design may be computed from the code .....

(viii) As per the code IS-456, for deflection control, the basic value of span to effective depth ratio, for continuous spans up to 10 m, should not be greater than .....26.....

(ix) For RCC slabs spanning in two directions, the ..... of the two spans should be used for calculating the span to effective depth ratios, as per the code IS-456.

(x) Dead load for RCC structure design may be computed from the code .....

(xi) Diameter of steel reinforcing bars should not exceed .....10.....mm for a 100 mm thick RCC slab.

(xii) Mild steel bars in either direction in RCC slabs should not be less than -------- of total cross-sectional area.

Group-B (Short Answer Type Question)

Answer any three of the following [5 x 3 = 15]

2. Why are the under-reinforced RCC beam sections much better than the over-reinforced RCC sections ? [5]
3. Determine Fe415 reinforcement for 300 mm x 600 mm M15 beam section with 150 kN.m bending moment. [5]
4. Explain the concept of stress block for limit state of collapse in flexure. https://www.makaut.com [5]
5. Calculate Fe250 stirrups for shearing force of 100 kN in 250 x 400 mm M15 beam with 1 % steel re-bars. [5]
6. Explain, in brief, the structural design procedure of RCC piles and pile cap. [5]

Group-C (Long Answer Type Question)

Answer any three of the following [15 x 3 = 45]

7. Find out the moment of resistance of a singly reinforced concrete beam of 200 mm width and 400 mm effective depth, if the beam is reinforced with 4 rebars of 16 mm diameter. Consider the grade of steel as Fe415 and grade of concrete as M20. Also, redesign the steel reinforcements in this RCC beam, if required, in compliance with the specifications of the relevant IS code. [15]
8. Design a balanced singly-reinforced concrete beam section for an applied moment of 60 kN.m in the service condition, if the width of the RCC beam is limited to 175 mm due to some architectural constraints. The design is to be done by using M20 grade of concrete and Fe415 grade of steel reinforcement bars. Also, the design must conform to all the relevant specifications of the code IS:456. [15]
9. Design a four-span continuous RCC slab for a 6.5 m wide and 13.5 m long hall, by using M20 grade concrete mix and HYSD steel rebars of grade Fe415, if the RCC slab is to be monolithically supported on three intermediate RCC beams of 240 mm sectional width and if the ends of the RCC slab are to be supported on the brick walls of the hall. The roof finishing load is 1.5 kN/m^2 and the service live load on the RCC slab may be taken as 2 kN/m^2 . [15]

10. Determine the steel reinforcements for a RCC beam if the effective depth of the beam is kept equal to 500 mm due to some architectural constraints. The beam is subjected to a maximum bending moment of 60 kN.m during the service life of the structure and the width of the RCC beam is li nited to 175 mm due to space restrictions. The design is to be done by using M20 grade o concrete and Fe415 grade of steel reinforcement bars. Also, find out whether the given beam section is to be doubly-reinforced or not. [15]

11. A 250 mm wide RCC beam section, having an effective depth of 400 mm, is subjected to ultimate design shear force of 150 kN at the critical section near the supports. The tensile reinforcement at the support location is 0.5 percent. Design the stirrups near the beam supports. Also, design the minimum shear reinforcement at the mid-span, where the shearing force is nearly zero. Assume concrete of grade M20 and mild steel bars of Fe250 grade. [15]

*** END OF PAPER ***