Total No. of printed pages = 3

CE 181502

Roll No. of candidate | | | | | | | | | | |

02/01/23

2022

B.Tech. 5th Semester End-Term Examination

STRUCTURAL DESIGN – I

(New Regulation & New Syllabus)

Full Marks – 70 Time – Three hours

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

Answer question no 1 and any *four* from the rest. Assume any data required.

1. Choose the correct answer for the following multiple choice questions $(10 \times 1 = 10)$

(i) Limit state of collapse desk with

(a) Crack width (b) Deflection

(c) Strength (d) All of the above

(ii) Multiple safety factors are used in

(a) Working stress method (b) Limit state method

(c) Ultimate Load method (d) None of the above

(iii) The non-dimensional parameter K for Fe 500 to find Limiting moment of resistance is

(a) 0.1338 (b) 0.1389

(c) 0.4160 (d) 0.1498

(iv) Raft foundations are used when

(a) SBC is high (b) SBC is low

(c) Footing touches the boundary (d) None of the above

(v) Spacing of longitudinal bars measured along the periphery of the column shall not exceed

(a) 150mm

(b) 300mm

(c) 5 times the nominal diameter of coarse aggregate

(d) 450mm

[Turn over

(vi) In a one way slab, shear reinforcement is provided

(a) Along the edge up to a distance $0.1l_x$

(b) Along the edge up to a distance $0.125\ l_x$

(c) Shear reinforcement not required

(d) None of the above

(vii) Bond resistance in reinforced concrete is achieved through

(a) Chemical adhesion and frictional resistance

(b) Mechanical adhesion due to the surface protrusions.

(c) Both (a) and (b)

(d) (b) but not (a)

(viii) Fill in the blanks.

The calculated tension or compression in any bar at any section shall be developed on each side of the section by an appropriate ———— or end anchorage or by a combination thereof.

(ix) In a staircase

(a) Stair slab may span transversely

(b) Stair slab may span longitudinally

(c) Both (a) and (b) are possible

(d) (a) is possible but (b) is impossible

(e) (b) is possible but (a) is impossible

(x) Slenderness limits for columns are that

(a) The unsupported distance between end restrains shall not exceed 60 times the least lateral dimension a of a column

(b) The unsupported distance between end restrains shall not exceed 45 times the least lateral dimension a of a column

(c) The unsupported distance between end restrains shall not exceed 30 times the least lateral dimension a of a column

(d) None of the above

2. (a) What are the different types of shear reinforcements? (3)

(b) What is shear friction? Explain. (3)

(c) A Singly reinforced RCC section has overall dimensions 250mm × 650 mm. 4 nos of 20 mm dia Fe 415 bars are provided at an effective depth of 600mm. M20 concrete is used. Find (A) Transformed second moment of area and Cracking moment (WSM); (B) Stresses due to applied moment of 90kNm (WSM); (C) Neutral axis depth (WSM). (9)

3. (a) Differentiate WSM and LSM. (2)

(b) Determine the ultimate moment of resistance of the doubly reinforced beam section having dimensions 300mm × 600mm. $A_{st} = 3045\,mm^2$, $A_{sc} = 982\,mm^2$, $f_y = 415MPa$, $f_{ck} = 25\,MPa, d' = 50\,mm$. (13)

4. (a) Differentiate one way and two way slab. (2)

(b) Consider the floor-slab system of a two storied building. The slab system is supported on load bearing masonry walls. The clear dimension of the slab is 4.0 m × 4.5 m. Assume floor finish of 10kN/m² and live load of 3.5kN/m². Use mild exposure condition and Fe 415 steel. Your answer should be accompanied by a detailed diagram. One short edge is discontinuous. (13)

5. (a) What is the minimum eccentricity for which the column is designed? (2)

(b) Design the reinforcement in a column of size 450mm × 550mm subjected to an axial load of 1500kN.(under service dead and live loads). The column has an unsupported length of 3.2m and braced against sideways in two directions. Use M25 concrete and Fe 500 steel. (13)

6. Design an isolated footing for a column 300mm × 450mm reinforced with 6-250 ϕ bars with Fe415 and M25. The column is subjected to a factored axial load of 900kN and uniaxial moment M_{ux}=90 KNm (with respect to the major axis) at the column base. Safe bearing capacity of soil is 180kn/m² at a depth of 1.25m.Assume M 25 concrete and Fe 415 steel. Answer should be accompanied by neat diagram. (13+2)

7. Design the staircase slab spanning longitudinally. The stairs are simply supported on beams provided at the first riser and at the edge of the upper landing. Assume finish load of 1.0 kN/m² and live load 5.0 kN/m² Assume mild exposure conditions. Grade of steel Fe 415 span of the staircase = 4.5m. (15)