

KATHMANDU UNIVERSITY
End Semester Examination [C]
November/December, 2023

Marks Scored:

Level : B.E./B.Tech.

Course : CIEG 310

Year : III

Semester : II

Exam Roll No. :

Time: 30 mins.

F. M. : 10

Registration No.:

Date

03 DEC 2023

Use of code IS 456:2000 & Design Aid SP 16 is not allowed in this section.

SECTION "A"

[20 Q. × 0.5 = 10 marks]

Choose and encircle the most appropriate option.

- If 'R' is the resistance of structural elements and 'L' is the working loads then, which of the following is correct relation for Working Stress Design method:
a. $\mu R < L$ b. $\mu R > L$ c. $R < \mu L$ d. $R > \mu L$
- The maximum compressive stress for concrete in limit state method of design is taken as:
a. $0.466f_{ck}$ b. $0.87f_{ck}$ c. $0.78f_{ck}$ d. $0.446f_{ck}$
- The limiting Moment of Resistance, $M_{u,lim}$ of section with Fe500 grade steel is equal to:
a. $0.133f_{ck}bd^2$ b. $0.138f_{ck}bd^2$ c. $0.148f_{ck}bd^2$ d. $0.152f_{ck}bd^2$
- The beam has a width of 300mm and overall depth of 600mm. If clear cover for beam is 30mm and 4 nos. 20mm diameter bar is used, the percentage of steel in beam is :
a. 0.70% b. 0.75% c. 0.72% d. 0.66%
- Spacing of stirrups in a rectangular beam is:
a. Kept constant throughout the length c. Decreased towards the centre of the beam
b. Decreased at the ends of beam d. Increased at the ends of the beam
- According to IS 456:2000, the minimum number of bars to be provided in circular column is:
a. 6 b. 8 c. 4 d. 5
- In case of two way slab the load is carried mainly in:
a. Short span b. Long span c. Both spans d. Half of long span
- For a flanged beam, area of steel required as compared to rectangular beam is:
a. Less b. Equal c. More d. Twice
- Minimum area of steel per m width to be provided in slab of depth 100mm for Fe415 grade steel is:
a. 1200 mm^2 b. 1500 mm^2 c. 150 mm^2 d. 120 mm^2
- According to IS 456:2000, for a continuous beam having effective depth of 500mm, the maximum span to satisfy the vertical deflection is:
a. 7m b. 15m c. 13m d. 10m

11. Two columns carrying ultimate axial loads of 1000 kN and 1500 kN are spaced 4m apart. For the uniform pressure distribution under footing, the C.G. of footing from 1000kN loaded column shall be at distance of:
a. 2.15m b. 2.8m c. 3.25m d. 2.4m
12. If the stress under footing exceeds the safe bearing capacity of soil, we should:
a. Increase the depth of footing c. Decrease the depth of footing
b. Decrease the area of footing d. Increase the area of footing
13. In a footing of size 3m x 3m with a column size of 300mm x 300mm, if the effective depth of footing is 500mm, the perimeter of critical section for two way shear is:
a. 3200 mm b. 4000 mm c. 2200 mm d. 5200 mm
14. For a circular column of unsupported length 3m and diameter 400mm, determine the minimum eccentricity to be considered in design.
a. 7.33 mm b. 10.8 mm c. 19.33 mm d. 25.8 mm
15. In a slab, 12mm bars are provided at a spacing of 200mm C/C. If it has to be replaced with 10mm bars, determine the spacing of bars required.
a. 119 mm b. 128 mm c. 139 mm d. 247 mm
16. If w_s is the self-weight of staircase slab on slope and θ is the angle between sloping slab and horizontal, then self-weight of slab on horizontal span is:
a. $w_s/\cos\theta$ b. $w_s/\sin\theta$ c. $w_s \cdot \sin\theta$ d. $w_s \cdot \cos\theta$
17. Total losses of the pre-stress that could be encountered under normal conditions of work for pre-tensioning work is about:
a. 5% b. 10% c. 25% d. 35%
18. Minimum grade of concrete to be used for pre-tensioned member is:
a. M30 b. M40 c. M50 d. M60
19. As the percentage of steel in beam increases:
a. Depth of neutral axis decreases c. Depth of neutral axis increases
b. Neutral axis remains same d. Lever arm increases
20. Which of the following is related to the limit state of serviceability?
a. Deflection b. Flexure c. Compression d. Shear

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F. M. : 40

*Make a suitable assumptions if necessary.
Use of code IS 456:2000 & Design Aid SP 16 is allowed.
Detail drawings should be done wherever required.*

SECTION "B"

Attempt ALL questions.

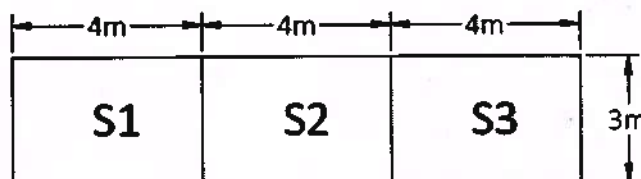
1. A simply supported rectangular beam of section 230mm x 600mm has an effective span of 6m. The imposed load on the beam is 40 kN/m. Using M20 concrete and Fe415 steel design the beam for flexure. Adopt effective cover for reinforcement as 50mm. Also check for safety of beam against deflection and calculate necessary development lengths for bar. [9]
2. Determine the ultimate moment of resistance of a simply supported isolated L-beam, having a span of 6 m, actual width of flange as 1000mm, width of web as 300mm & depth of slab as 120mm. The depth of beam upto the centroid of reinforcement is 600mm. It consist of 4 nos. 25mm dia. bars on tension side. Use M20 concrete and Fe415 grade steel. [6]

OR

Design the reinforcements required for a rectangular beam section with following data: [6]

Size of beam: 300mm x 600mm
Grade of concrete: M20
Grade of steel: Fe415
Factored shear force: 95 kN
Factored bending moment: 115 kN.m
Factored torsional moment: 45 kN.m

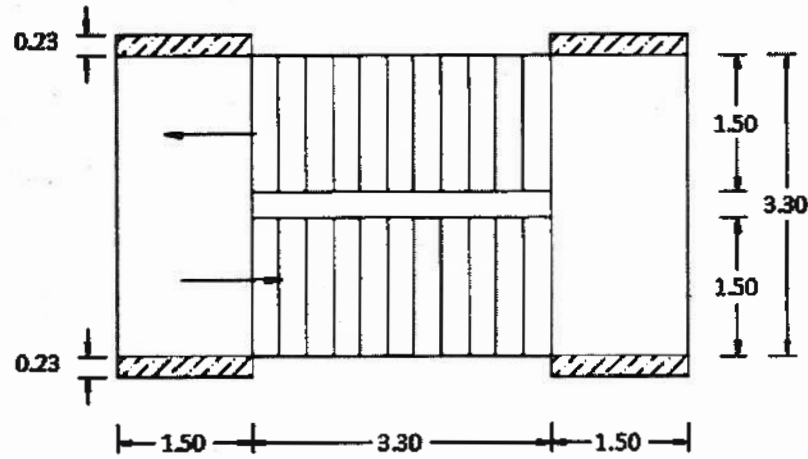
3. Figure below shows a slab system of a floor. Design the slab panel S2. Assume live load of 4 kN/m² and floor finish of 1 kN/m² Concrete of M20 grade and Fe415 HYSD bars are available for use. Also check for shear and deflection of slab. [9]



OR

Design a dog-legged staircase as shown in figure where landing slab is supported on side walls. Adopt following data: [9]

Rise= 150mm, tread= 300mm, No. of treads= 11, width of stair= 1.50m,
concrete grade= M20, Steel grade= Fe415



All dimensions are in m.

4. A solid footing has to transfer a dead load of 1000 kN and live load of 400 kN from square column 400×400 mm. Assuming M20 grade concrete and Fe415 grade steel, and safe bearing capacity of soil to be 250 kN/m^2 , design the footing. [9]
5. A column of unsupported height 5m hinged at both ends is subjected to ultimate axial load of 1200 kN. Design the section as short axially loaded column with minimum possible size using M20 concrete and Fe415 grade steel. Detail the lateral ties for this column. [4]
6. Differentiate between pre-tensioning and post-tensioning methods of pre-stressed concrete. [3]