KATHMANDU UNIVERSITY
End Semester Examination
July/August, 2024

Marks Scored:

Level : B.E.
Year : III

Course : CIEG 310
Semester : II

Exam Roll No. :

Time: 30 mins.

F. M. : 10

Registration No.:

Date 05 AUG 2024

No any design code is allowed for this section.

SECTION "A"
[20 Q. × 0.5 = 10 marks]

Choose and encircle in the most appropriate option from each set of choices

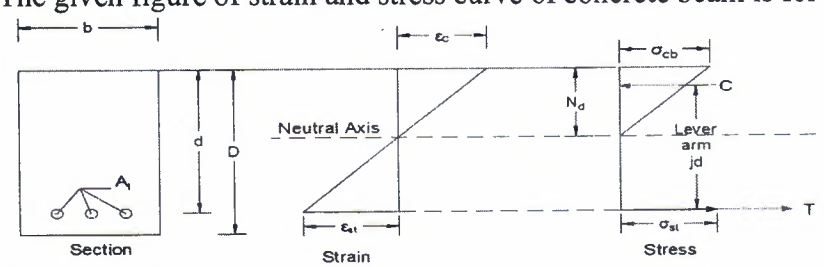
1. As per IS 456:2000 , standard concrete group is of grade designation
   a. M10 to M20 b. M25 to M55 c. M25 to M60 d. M60 and above

2. Strain at the level of compression steel in DRB is (each symbol has standard meaning)
   a. $\varepsilon_{sc} = 0.0035\left(1 - \frac{d'}{x_{max}}\right)$ b. $\varepsilon_{sc} = 0.0055\left(1 - \frac{d'}{x_{max}}\right)$
   c. $\varepsilon_{sc} = 0.0035$ d. $\varepsilon_{sc} \geq \left(0.002 + \frac{0.87\sigma_y}{E_s}\right)$

3. There are following exposure conditions considered in IS 456:2000
   a. Mild , Severe and Extreme
   b. Mild, Moderate and Severe
   c. Mild, Moderate, Severe and Extreme
   d. Mild, Moderate, Severe, Very Severe and Extreme

4. Minimum time period before striking for soffit formworks to beam (props to be refixed immediately after removal of formwork) is
   a. 16 to 24 hours b. 3 days c. 7 days d. 28 days

5. The given figure of strain and stress curve of concrete beam is for



   a. Working stress method b. Load factor method
   c. Limit state method d. Performance based method

6. As per **IS 456:2000**, for limit state method, stress block in beam cross section will be rectangular for
   a. The depth of 4x/7 from extreme compression fibre
   b. The depth of 3x/7 from extreme compression fibre
   c. The depth of x from extreme compression fibre
   d. The depth of 0.42x from extreme compression fibre

7. For Fe-500 steel, limiting value of neutral axis depth is
   a. 0.46d b. 0.40d c. 0.43d d. 0.38d

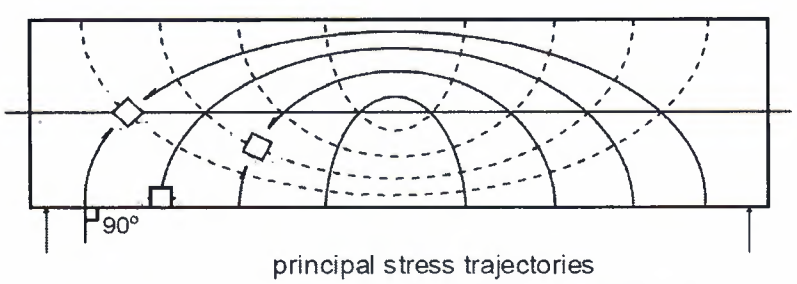
8. Limiting percentage of tension reinforcement (P_{lim} %) in Singly Reinforced Beam is
   a. $\frac{0.36\sigma_{ck}}{0.87\sigma_y}\left(\frac{x_m}{d}\right)$ b. $\frac{36\sigma_{ck}}{0.87\sigma_y}\left(\frac{x_m}{d}\right)b$ c. $\frac{0.36\sigma_{ck}}{0.87\sigma_y}\left(\frac{x_m}{d}\right)b$ d. $\frac{36\sigma_{ck}}{0.87\sigma_y}\left(\frac{x_m}{d}\right)$

9. For beam, **INCORRECT** statement is
   a. $\frac{0.85\,bd}{\sigma_y} \le A_{st} \le 0.04bD$
   b. $V_{us} = 0.87\sigma_y A_{sv}\left(\frac{d}{S_v}\right)$ *for vertical stirrups*
   c. $V_{us} = V_u - \tau_v bd$ τ_v *is nominal shear stress*
   d. $S_v = \frac{0.87\sigma_y A_{sv}}{0.4\,b}$ *for minimum shear stirrups*

10. For same grade of steel, ratio of development length for steel bar with diameter of 20 mm and 16 mm is
    a. 4/5 b. 25/16 c. 5/4 d. 16/25

11. **IS 456:2000, recommends**
    a. Nominal cover should not be less than diameter of bar
    b. Nominal cover is the design depth of concrete cover to all steel reinforcement including links
    c. For footing minimum cover shall be 50 mm
    d. Value of nominal cover is independent of exposure condition.

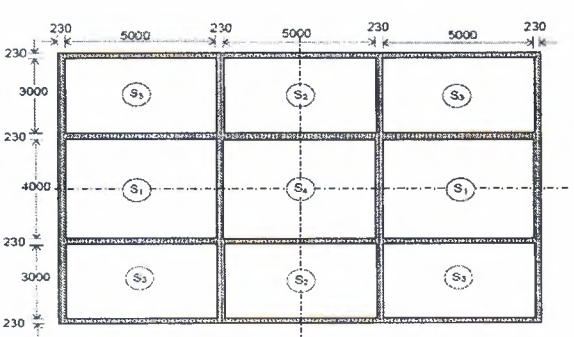
12. Figure shows principal stress trajectories for a simply supported beam under external loading, the direction of tensile stress are shown by



principal stress trajectories

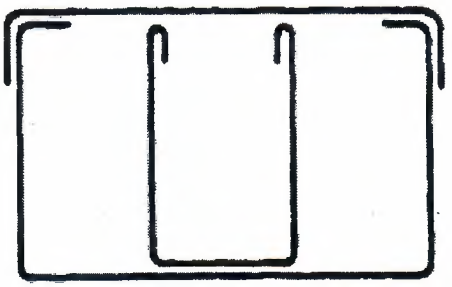
    a. Solid lines b. Dotted lines
    c. Both dotted and solid lines d. Intersection of dotted and solid lines

13. For the given floor slab system, S1 is



    a. One short edge discontinuous
    b. One long edge discontinuous
    c. All edge discontinuous
    d. d. Interior panel

14. Given typical stirrup (beam stirrup) is
    a. 2 legged stirrup
    b. 3 legged stirrup
    c. 4 legged stirrup
    d. 6 legged stirrup



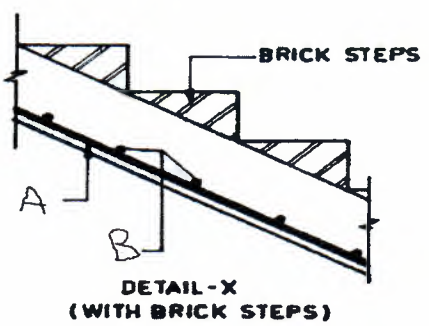
15. For short axially loaded column, **INCORRECT** statement is
    a. $e_{min} = \frac{l}{500} + \frac{D}{30}$ *and not less than* 20 *mm*
    b. $P_{uz} = 0.45\, f_{ck}\, A_c + 0.75\, f_y\, A_{sc}$
    c. $e_{min} \leq 0.05B \text{ or } 0.05D$
    d. $P_u = 0.4\, f_{ck}\, A_c + 0.67\, f_y\, A_{sc}$

16. For the beam with M20 and Fe415 (effective depth of 500 mm and width of 300 mm) , MOR of the section is
    a. 207 kNm b. 199.5 kNm c. 222 kNm d. 300 kNm

17. If the ratio of the span in longer direction to the shorter direction of a slab is more than 2, then bending moment in the direction of larger span is
    a. Equal to that of shorter span b. Very high
    c. Very small d. More than that of shorter span

18. For two way shear in foundation design, the shear strength of concrete depends on
    a. Percentage of tension reinforcement provided in footing and grade of concrete
    b. Grade of concrete and percentage of shear reinforcement
    c. Grade of concrete and percentage of main and distribution rebar
    d. Only on Grade of concrete

19. For the Given portion of rebar detailing of waist slab of doglegged staircase. Correct statement about the rebar A and B is
    a. Bar A are main reinforcement and B are distribution rebar
    b. Bar B are main reinforcement and A are distribution rebar
    c. Both A and B are main reinforcement
    d. Both A and B are distribution reinforcement



20. Beam (200 mm by 400 mm effective section) is reinforced with 3 no. of 12 mm diameter bar in tension face. For M20 and Fe415, The section is
    a. Balanced
    b. Under reinforced
    c. Over reinforced
    d. Both under reinforced and over reinforced

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IS456:2000, IS 1343 (for prestressed concrete) and IS456-SP-16 is allowed to use.

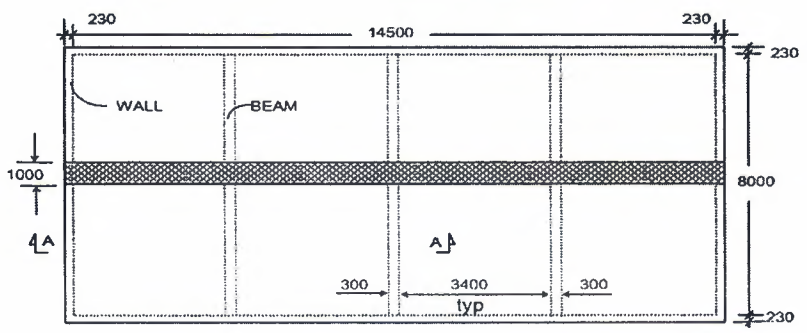
SECTION "B"

Attempt *ALL* questions. *Assume suitable data if necessary.*

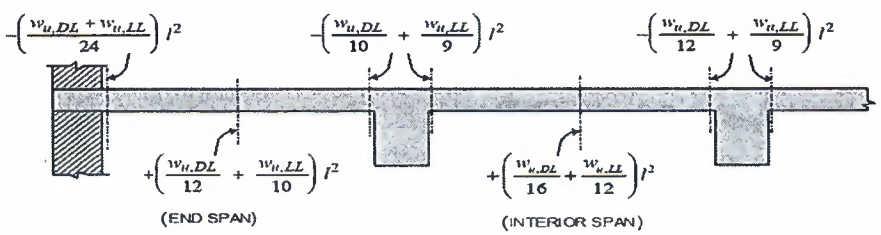
1. Determine the ultimate moment of resistance (by formulae method) of the following T-beam: B_f = 450 mm, D_f = 150 mm, d = 440 mm, A_{st} = 2100 mm^2, Grade of steel and concrete are Fe415 and M25. [5]

2. A rectangular reinforced concrete beam, located inside a building in Kathmandu Valley, is simply supported on two masonry walls 230 mm thick and 6 meter apart (center to center). The beam has to carry, in addition to its own weight, a distributed live load of 10 kN/m and dead load of 5 kN/m. **Design and Detail** the beam section for maximum bending moment at midspan. Assume Fe 415 and M25 Concrete. [7]

3. The plan of a floor slab system, covering an area 8.0 m by 14.5 m (clear spans) is shown in Figure (3A and 3B). The slab rest on a 230 mm thick masonry wall all around. For economy, the span of the slab is reduced by providing three (equally spaced) intermediate beams (of 300 mm width) along the 8.0 meter direction as in figure. The specified floor loading consists of a live load of 4 kN/m2 and a dead load of 1.5 kN/m2 in addition to the self-weight. Assuming Fe 415 and M25, Design and Detail the floor slab. [8]



(A) PLAN



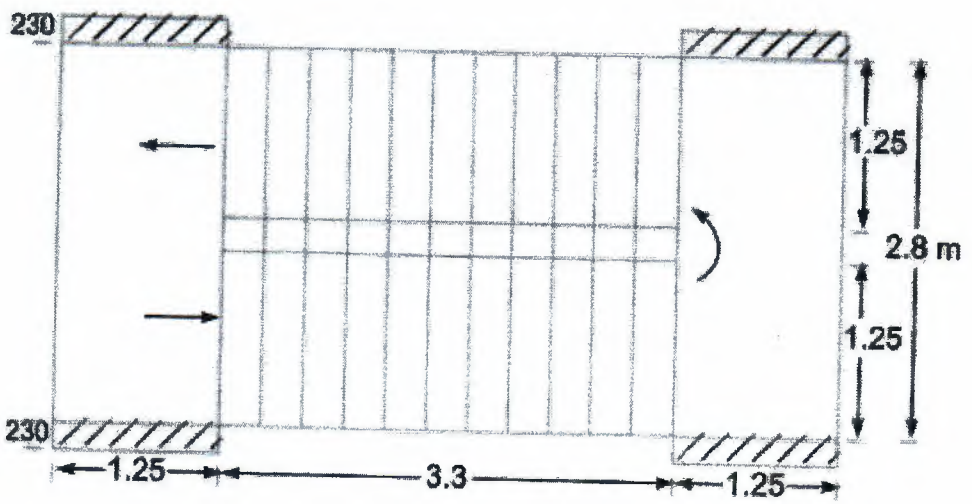
(B) SECTION A – A
(not to scale)

4. A column 300 mm by 400 mm has an unsupported length of 3 meter and effective length of 3.6 meter. If it is subjected to Pu = 1100 kN and Mu = 230 kNm about the major axis, **Design** (Longitudinal and transverse steel) and **Detail** the column. Using M25, Fe 415 and effective cover 60mm. [6]

5. **Design and detail** a square isolated footing for a short axially loaded column of size 300 mm by 300 mm carrying 600 kN load. Use M20 concrete and Fe 415 Steel. SBC of a soil is 250 kN/m2. [8]

6. **Design and detail** a dog legged staircase for an office building, given the following data:
   - Height between floor = 3.2 meter
   - Riser = 150 mm, Tread = 300 mm
   - Width of flight = width of landing = 1250 mm
   - Live load = 3 kN/m^2
   - Use M20 and Fe 415.

[6]



OR

a. Discuss on the different types of prestress systems. [2]
b. Describe the process of determination of flexural strength of plain beam as per IS 516:1959. [4]