

KATHMANDU UNIVERSITY
End Semester Examination
February, 2025

Marks Scored:

Level : B.Arch.

Year : IV

Exam Roll No. :

Time: 30 mins.

Course : CIEG 431

Semester : I

F. M. : 10

Registration No.:

Date :

21 FEB 2025

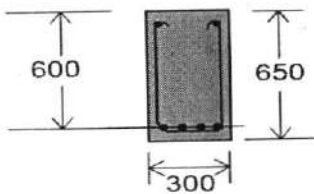
No any code is allowed for this section.

SECTION "A"
[20Q. × 0.5 = 10 marks]

Choose the most appropriate answer and **encircle**.

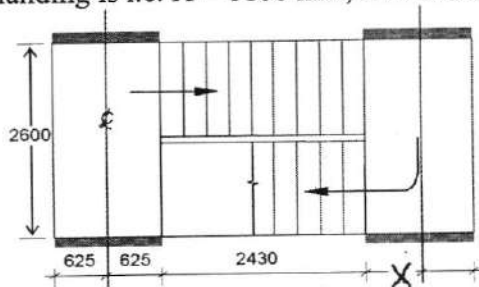
1. Number of Exposure conditions As per IS 456:2000 are
a. 3 b. 4 c. 5 d. 6
2. The maximum stress of concrete in flexural compression for design purpose is taken as
a. f_{ck} b. $0.67 f_{ck}$ c. $0.67 f_{ck}/\gamma_m$ d. $0.36 f_{ck} x_u$
Where, f_{ck} , γ_m and x_u are characteristic compressive strength of concrete, partial safety factor for concrete and depth of neutral axis.
3. Flexural strength of concrete as per IS 456:2000 is
a. $\sqrt{f_{ck}}$ b. $0.7 \sqrt{f_{ck}}$ c. $0.446 f_{ck}$ d. $0.67 f_{ck}$
 f_{ck} is characteristic cube compressive strength of concrete in MPa.
4. Minimum Reinforcement to be provide in tension face for Flexural Member beam is
a. $\geq \frac{0.85 bd}{f_y}$ b. $\geq \frac{0.85 f_y}{bd}$ c. $\geq 0.04bd$ d. $\geq 0.15\%$ for mild steel
5. Limiting Moment Carrying Capacity of a Rectangular RC beam with width of "b" and effect depth of "d" for M20 and Fe500 is
a. $2.60 \times b \times d^2$ b. $2.66 \times b \times d^2$ c. $2.76 \times b \times d^2$ d. $2.96 \times b \times d^2$
6. A beam of gross depth 500 mm and effective cover of 50 mm is reinforced with Fe-415 steel. If the actual value of neutral axis depth is 220 mm, then the beam section is
a. Balanced section b. Under reinforced section
c. Over reinforced section d. Rectangular or flanged section
7. As the percentage of tensile reinforcement increases
a. Design shear strength of concrete (τ_c) increases
b. Maximum shear strength of concrete (τ_{cmax}) increases
c. Nominal shear stress (τ_v) increases
d. Both Design shear strength and nominal shear stress increases
8. As per IS 456:2000, minimum spacing of the shear stirrups (S_v) in beam is
a. $S_v < \frac{2.175 \sigma_y A_{sv}}{b}$ b. 300 mm c. 0.75d d. d
Where, σ_y , A_{sv} , b and d are yield strength of stirrups, area of stirrups, width of beam and effective depth of the beam.

9. Given is a beam section with shear stirrups and main tension reinforcement. The beam is with



- a. One legged stirrups
b. Two legged stirrups
c. Three legged stirrups
d. Six legged stirrups
10. Splices of bars in flexural members should not be at sections where the bending moment is more than 50 percent of the moment of resistance; and not more than half the bars shall be spliced at a section. For the splicing the **INCORRECT** statement is
- a. Lap splices are usually not permitted for large diameter bars > 36 mm
b. Lap length should be at least equal to the development length
c. Lap length should be at least 2 times development length if the member is subjected to direct tension
d. If the bars of different diameter are to be spliced, then the lap length should be calculated with respect to larger diameter.
11. If the development length for bars in tension is "L" then the development length of same bar in compression is
- a. L
b. $0.8L$
c. $1.25L$
d. $0.625L$
12. For a simple support (RC beam resting on masonry wall), the positive moment tension reinforced shall be limited to a diameter such that development L_d computed does not exceed
- a. $\frac{M_1}{V} + L_0$
b. $\frac{1.3 \times M_1}{V} + L_0$
c. $\frac{M_1}{V}$
d. L_0
- Where, M_1 , V and L_0 are MOR of the beam section, shear force at the section due to design load and anchorage length
13. Basic value of span to depth ratio for the flexural member beam up to span of 10 meter if it is continuous is
- a. 7
b. 20
c. 26
d. 35
14. For a rectangular column of cross section 300 mm by 500 mm. Provided longitudinal reinforcements are 4 Number of 16 mm diameter bar and 4 number of 20 mm diameter bar. Then the spacing of lateral tie should be
- a. Less than or equal to 256 mm
b. Less than or equal to 300 mm
c. Less than or equal to 500 mm
d. Less than or equal to 320 mm
15. Unsupported length of a column is 5000 mm. It is effectively held in position and restrained against rotation at one end but not held in position nor restrained against rotation at the other end, then the recommended value of effective length of the column as per IS456:2000 is
- a. 3250 mm
b. 4000 mm
c. 5000 mm
d. 10000 mm

16. For a square column of cross section 600 mm by 600 mm and unsupported length 6000 mm. The minimum eccentricity to be considered for the design is
 a. 20 mm b. 30 mm c. 32 mm d. 64 mm
17. If the effective length of short span and long span of the slab is 4 meter and 9 meter, the slab is
 a. Rectangular slab b. Flat slab c. One way slab d. Two way slab
18. For a slab having four edges discontinuous and aspect ratio ($L_y/L_x = 1$), bending moment coefficients along both directions are 0.056. If the moment along short direction and long direction are M_x and M_y , then
 a. $M_x = M_y$ b. $M_x > M_y$
 c. $M_x < M_y$ d. M_x and M_y are not related
19. For a plan of a dog legged staircase, if all the dimensions are in mm, half width of right landing is i.e. $X = 1100$ mm, then the effective length of the staircase is



- a. 4780 mm b. 2430 mm c. 4155 mm d. 4055 mm
20. For a square isolated footing of plan dimension 5 meter by 5 meter, and effective depth of 1000 mm, the critical section of moment is at
 a. the face of column
 b. a distance 1000 mm far from face of a column
 c. a distance of 500 mm far from face of a column
 d. the center of column

KATHMANDU UNIVERSITY
End Semester Examination
February, 2025

Level : B.Arch.
Year : IV
Time : 2 hrs. 30mins.

21 FEB 2025

Course : CIEG 431
Semester : I
F. M. : 40

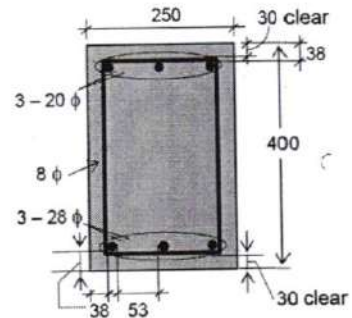
Make suitable assumptions if necessary. Use of code IS456:2000, IS1893:2016 and Design aid SP-16 is allowed. Detailed drawings should be done wherever required.

SECTION "B"

[6 Q. × 4 = 24 marks]

Attempt ANY SIX questions.

1. Starting from the stress and strain diagram of a rectangular RC beam, derive the expression for moment of resistance; $M_u = 0.87 \sigma_y A_{st} d \left[1 - \frac{\sigma_y A_{st}}{\sigma_{ck} b d} \right]$. [4]
2. Write shortly with the help of neat figure about the flexural failure modes and shear failure modes of RC beam. [4]
3. Check the provided depth of the beam is adequate or not. Assume beam is S/S with effective span of 6 meter. M25 and Fe 415. Ratio of required and provided reinforcement is 1. [4]



4. A 250 mm wide and 600 mm deep RC beam is reinforced with 2 legged 10 mm inclined stirrups at 250 mm c/c with inclination of $\alpha = 60$ degree. Longitudinal steel consists of 4 bars of 20 mm with an effective cover of 40 mm. Assuming M25 and Fe- 415 steel, determine the strength of the section in shear. [4]
5. For a short axially loaded column of size 450 mm by 450 mm carrying service load of 2300 kN. Assuming M20 and Fe-415 steel. SBC of soil is 300 (kN/m²). Determine: [4]
 - i. The area required of square footing.
 - ii. Soil reaction on that footing.
 - iii. Depth of footing required for one way shear considering 0.25% of tension reinforcement. And depth required for footing for two way shear.
6. Design and detail a short axial column of size 300 mm by 400 mm, subjected to factored axial load $P_u = 1100$ kN and factored moment $M_u = 150$ kNm about the major axis. Consider M25 and Fe 415, provide steel on four sides and assume effective cover of 60 mm. [4]
7. Differentiate among singly reinforced beam, doubly reinforced beam and flanged beam. Furthermore write what are the favorable cases for each type of beam to be provided. [4]

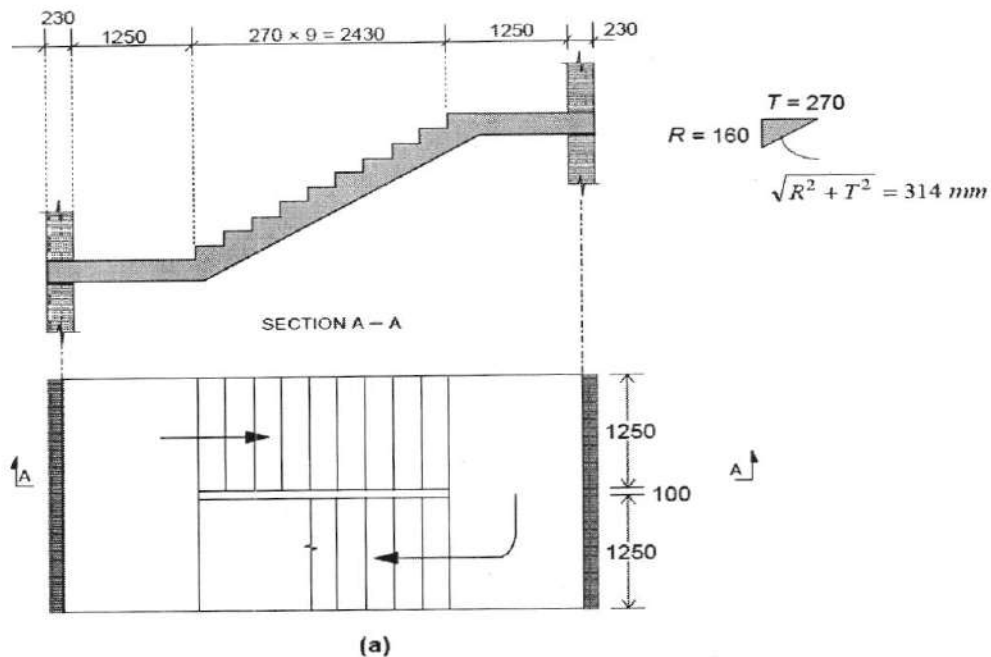
P.T.O.

SECTION "C"
[2 Q. × 8 = 16 marks]

Attempt ANY TWO questions.

8. A rectangular beam is to be simply supported on supports of 230 mm width. The clear span of the beam is 6 meter. The beam is to have width of 300 mm. Live load on the beam is 12 kN/m. Use M20 and Fe 415 steel. Determine:
- Longitudinal reinforcement [3]
 - Shear reinforcement [3]
 - Check for deflection [1]
 - Detail the beam [1]
9. Design a Doglegged staircase for an office building, given the following data:
- Clear Room for staircase is 4930 mm by 2600 mm
 - Floor to floor height = 3200 mm
 - Riser = 160 mm, Tread = 270 mm
 - Width of flight = width of landing = 1250 mm
 - Live load = 5 kN/m², Finishes load = 0.6 kN/m² and Use M20 and Fe 415

Assume the stairs to be supported on 230 mm thick masonry walls at the outer edges of the landing, parallel to the risers. [8]



10. Design and Detail a floor slab for a room of clear internal dimensions 3 meter by 5 meter supported on walls of 300 mm thickness. Two adjacent edges of the slab are continuous and other two discontinuous. Live load on the slab is 3 kN/m². Assume floor finish of 1 kN/m². Use M20 and Fe 415. (not needed to check shear and deflection) [8]