KATHMANDU UNIVERSITY
End Semester Examination
January/February 2024
04 FEB 2024

Marks Scored:

Level : B.Arch.
Year : IV

Course : CIEG 431
Semester : I

Exam Roll No. :

Time: 30 mins.

F. M. : 10

Registration No.:

Date :

SECTION "A"

[20Q. × 0.5 = 10 marks]

Choose and encircle in the appropriate option.

1. The tensile strength of the concrete to be used for the design of RC members is
   a. $0.446\ f_{ck}$ b. $0.67\ f_{ck}$ c. $0.36\ f_{ck}$ d. $0.7\ f_{ck}^{0.5}$

2. The reinforcement ratio p_t in a balanced section of a RCC beam is
   a. $0.414 \left(\frac{f_{ck}}{f_y}\right)\left(\frac{x_{max.}}{d}\right)$ b. $\frac{1}{0.414}\left(\frac{f_{ck}}{f_y}\right)\left(\frac{x_{max.}}{d}\right)$
   c. 1.419 d. 1/1.419

3. If A_{sv} and s_v denote the area and spacing of the vertical stirrups and 'd' the effective depth, then the strength of the vertical stirrups is given by
   a. $\frac{0.87\ f_y\ A_{sv}}{s_v\ d}$ b. $\frac{0.87\ f_y\ A_{sv}\ d}{s_v}$ c. $\frac{0.87\ A_{sv}}{f_y s_v\ d}$ d. $\frac{0.87\ f_y}{A_{sv}\ d\ s_v}$

4. The minimum amount of bottom reinforcement, that should be continued over the entire length of the continuous RCC beam is
   a. 50% b. 40% c. 25% d. $33\frac{1}{3}\%$

5. When bars of two different diameters are to be spliced, the lap length is calculate on the basis of
   a. Diameter of larger bar b. Diameter of the smaller bar
   c. Mean diameter of the bar d. Three times the diameter of the larger bar

6. Moment of the Resistance (MOR) for the beam section (width 250 mm, effective depth 310 mm, effective cover 40 mm, reinforcement in tension face 3-12Φ, Steel of 415 MPa and Concrete of 20 MPa) is .....
   a. Section is under reinforced with MOR 34.5 kNm
   b. Section is balanced with MOR 34.5 kNm
   c. Section is over reinforced with MOR 34.5 kNm
   d. Section cannot be specified and MOR cannot be calculated with given detail

7. **INCORRECT STATEMENT** about the assumption for the limit state of Flexure is
   a. The maximum strain in the extreme outermost compression fiber in concrete is taken as 0.35% in bending regardless of the strength of the concrete
   b. The relationship between stress-strain distribution in concrete is assumed to be parabolic with maximum compressive stress equal to the characteristic strength of the concrete
   c. Tensile strength of the concrete is ignored
   d. Plane sections normal to the axis remains plane after bending

8. The allowable axial load on the short RCC column with helical reinforcement is given by
   a. $0.4\, f_{ck}A_g + (0.67\, f_y - 0.4\, f_{ck})A_s$
   b. $0.446\, f_{ck}A_g + (0.75\, f_y - 0.446\, f_{ck})A_s$
   c. $1.05\,[0.4\, f_{ck}A_g + (0.67\, f_y - 0.4\, f_{ck})A_s]$
   d. $1.05\,[0.446\, f_{ck}A_g + (0.75\, f_y - 0.446\, f_{ck})A_s]$

9. The minimum number of longitudinal reinforcement bar in helically reinforced RCC columns must be
   a. 4 b. 6 c. 8 d. 12

10. The ration of the volume of the helical reinforcement to the volume of the core should not be less than.....in case of circular column
   a. $0.36\,\frac{f_{ck}}{f_y}\left(\frac{A_g}{A_c}-1\right)$ b. $0.36\,\frac{f_y}{f_{ck}}\left(\frac{A_g}{A_c}-1\right)$
   c. $0.36\,\frac{f_{ck}}{f_y}\left(\frac{A_c}{A_g}-1\right)$ d. $0.36\,\frac{f_y}{f_{ck}}\left(\frac{A_c}{A_g}-1\right)$

   (Each term has its own unique meaning)

11. For Deformed bars, the allowable bond stress in tension is increases by...percent over the corresponding value of plain bars
   a. 20 b. 25 c. 33.33 d. 60

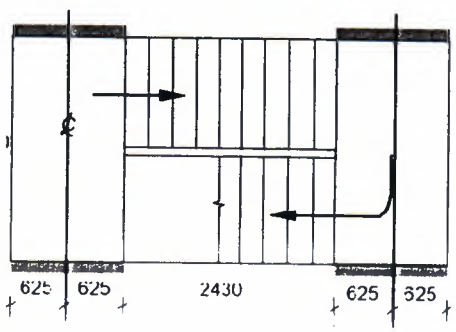
12. In a singly reinforced beam, if the concrete is stressed to its allowable limit earlies than steel, the section is said to be
   a. Over reinforced beam b. Under reinforced beam
   c. Balanced beam d. Economical beam

13. For simply supported two way slab of small span with HYSD bars of grade Fe-415, the span to overall depth ratio is limited to
   a. 20 b. 28 c. 35 d. 40

14. One way shear strength of the footing is checked at a distance equal to ....of the footing from the face of the column
   a. One half of the effective depth b. Effective depth
   c. One fourth of the effective depth d. Three forth of the effective depth

15. The effective length (Practical value) of the compression member i.e. column if effectively held in position at both ends and restrained against rotation at one end is .....(if the unsupported length of the column is L)
   a. 0.65 L b. 0.80 L c. 0.7 L d. 1.0 L

16. The effective length of the span of the given staircase is
   a. 3680 mm
   b. 4930 mm
   c. 2430 mm
   d. 600 mm



04 FEB ...4

17. The main reinforcement is cantilever RCC beam is placed at
a. Top fibre b. Bottom fibre c. Side fibre d. Top and bottom fibre

18. The minimum reinforced to be provided of HYSD bar in RCC slab is
a. 0.15% b. 0.12% c. 0.85% d. 4%

19. The probability of that the actual strengths of material is more than or equal to the characteristic strength is
a. 0.75 b. 0.8 c. 0.9 d. 0.95

20. A compressive member is termed as column or strut if the ratio of ties effective length to the least lateral dimeson is more than
a. 1 b. 2 c. 3 d. 12

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✓ *Make suitable assumptions if necessary.*
✓ *Use of code IS456:2000 and Design air SP-16 is allowed.*
✓ *Detailed drawings should be done wherever required.*

SECTION "B"
[6 Q. × 4 = 24 marks]

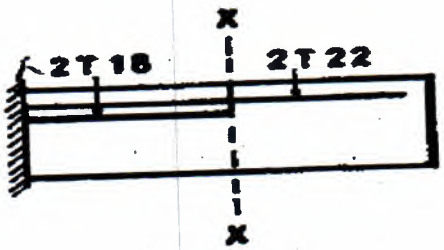
Attempt *ANY SIX* questions.

1. Derive that the limiting depth of neutral axis for a rectangular beam cross section reinforced with Fe-415 is 0.48×d, furthermore explain shortly about flexural failure modes of RCC beam.

2. Illustrate with the help of neat figures the curtailment rule for positive and negative reinforcement in a continuous RCC beam.

3. A singly reinforced beam 250 mm by 500 mm in section is reinforced with 4 bars of 16 mm diameter with an effective cover of 50 mm. Effective span of the beam is 6 meter. Assuming M20 and Fe250 steel, determine the central concentrated load P that can be carried by the beam in addition to its self-weight.

4. A cantilever beam is of 250 mm by 350 mm has 2 bars of 22 mm diameter and 2 bars of 18 mm diameter as tension steel. At a section X-X where the factored shear force is 110 kN, the 18 mm diameter bar may be curtailed and 22 mm diameter bar may be continued to the free end. Design the shear steel at the section X-X, if (i) Bars are not curtailed.



5. Design the reinforcement in a column of size 450 mm × 600 mm, subject to an axial load of 2000 kN under service dead and live loads. The column has an unsupported length of 3.0*m* and is braced against sideway in both directions. Use M 20 concrete and Fe 415 steel.

6. Design a reinforced concrete slab for a room of clear dimension 4 m by 5 meter. The slab is supported all around on walls of width 300 mm. the slab has to carry a live load of 4 kN/m2 and floor finish of 1 kN/m2. Use M20 and Fe-415. Assume corners are held down. (no need to check for shear, torsion and deflection)

7. Detail the reinforcement in typical doglegged staircase including development length, main bar and distribution bar. (Show rebar detail of section and plan in flight and landing).

SECTION "C"

[2 Q. × 8 = 16 marks]

Attempt *ANY TWO* questions.

8. Design (*longitudinal and shear rebar*) & Detail a Simply Supported rectangular beam of section (overall 230 mm by 600 mm) for an effective span of 6 meter. Effective cover for the reinforcement should be kept as 50 mm. Imposed load on the beam is 40 kN/m. Use M20 and Fe-415 steel. Furthermore check for the deflection.

9. Design and Detail a square footing for a short axially loaded column of size 300 mm by 300 mm carrying 600 kN load. Use M25 and Fe-500 steel. SBC of soil is 180 (kN/m^2).

10. **Design and Detail** a slab **panel S4** for a slab system supported on a masonry wall of 230 mm thick as in figure (all dimensions are in mm). Assume floor finish load of 1 kN/m^2, Live load of 4 kN/m^2. Use M20 concrete and Fe 415 steel.