**(Compulsory Question)**

9. (i) Define modular ratio.

(ii) Write the differences between Working Stress Method and Limit State Method.

(iii) What are the values of maximum depth of neutral axis for Fe 250, Fe 415 and Fe 500 ?

(iv) How the effective span of continuous beam or slab is calculated ?

(v) Define bond stress.

(vi) Write the values of nominal cover to reinforcement in beams and columns for mild, moderate, severe and very severe conditions.

(vii) A concrete pedestal made of M 20 mix is shown in Fig. Calculate the tan $\alpha$ value of this case.



$q_0 = 3$ MPa

---
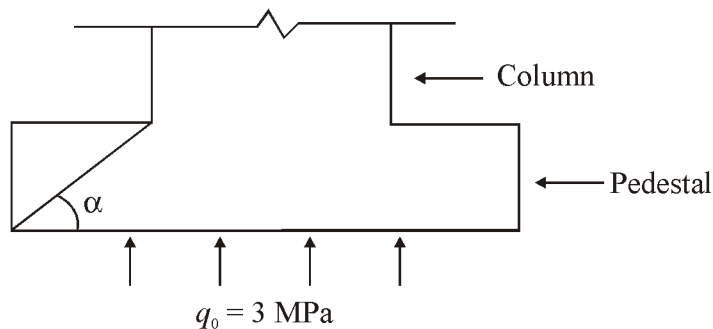
## J-21-0001

### B. Tech. EXAMINATION, 2021

Semester V (CBCS)

LIMIT STATE DESIGN OF CONCRETE STRUCTURES–I

CE-501

*Time : 2 Hours*      *Maximum Marks : 60*

---

*The candidates shall limit their answers precisely within 20 pages only (A4 size sheets/assignment sheets), no extra sheet allowed. The candidates should write only on one side of the page and the back side of the page should remain blank. Only blue ball pen is admissible.*

---

**Note :** Attempt *Four* questions in all, selecting *one* question from any of the Sections A, B, C and D. Q. No. **9** is compulsory. Relevant codes are allowed. Assume any missing data.

**Section A**

1. (a) What are the various assumptions on which the design for the limit state of collapse in flexure is based ?      **7.5**

(b) Explain under-reinforced and over-reinforced failure of a reinforced concrete beam.  **7.5**

2. What are the factors that influence the strength of concrete ? Briefly discuss the effect of water-cement ratio and workability on strength of concrete.  **15**

## Section B

3. Design a rectangular beam for an effective span of 6 m. The superimposed load is 80 kN/m and size of the beam is limited to 30 cm × 70 cm overall. Use M 20 mix and Fe 415 grade steel.  **15**

4. Design the RC floor slab for a room of internal dimensions 4.0 m × 9.5 m. Assume the slab to be simply supported on 230 mm thick masonry walls. The slab is to support live load of 4 kN/m$^2$ and surface finish of 1 kN/m$^2$. Use M 20 grade concrete, HYSD steel of Fe 415 grade. Draw reinforcement details.  **15**

## Section C

5. An RC beam has an effective depth of 500 mm and a breadth of 350 mm. It contains 4-25 mm bars. If

(i) $\sigma_{ck}$ = 15 N/mm$^2$ and $\sigma_{sv}$ = 250 N/mm$^2$, and

(ii) $\sigma_{ck}$ = 15 N/mm$^2$ and $\sigma_{sv}$ = 415 N/mm$^2$, calculate the shear reinforcement needed for a factored shear force of 350 kN.  **15**

6. A simply supported beam is 25 cm by 50 cm and has 2-20 mm TOR bars going into the support. If the shear force at the centre of support is 110 kN at working loads, determine the anchorage length. Assume M 20 and Fe 415 grade TOR steel.  **15**

## Section D

7. What do you mean by a tread riser staircase ? List out the steps for design. Draw a sectional elevation of this staircase showing the different reinforcements needed.  **15**

8. Design a square section column using M 15 concrete and mild steel bars to carry an axial load (P) of 30,000 kg. Effective length of column (left) = 4 m. Assume permissible stresses in direct compression in M 15 concrete ($\sigma_{cc}$) and in mild steel bars ($\sigma_{sc}$) as 40 and 1300 kg/cm$^2$ respectively. Sketch the arrangement for longitudinal and lateral reinforcement.  **15**

(viii) Write the values of short span to overall depth ratio for (a) simply supported slab with Fe 415 grade steel, (b) continuous slab with mild steel.

(ix) What are the requirements for lateral ties in reinforced sections ?

(x) Write the corresponding value of Euler's critical load when a column is fixed at both ends.

**10×1.5=15**