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1. The total compressive force at the time of failure of a concrete beam at the time of failure of a concrete beam section of width 'b' without considering the partial safety factor of the material and selender effect

   (a) $0.36\ f_{ck}bX_u$ (c) $0.66\ f_{ck}bX_u$

   (b) $0.54\ f_{ck}bX_u$ (d) $0.8\ f_{ck}bX_u$

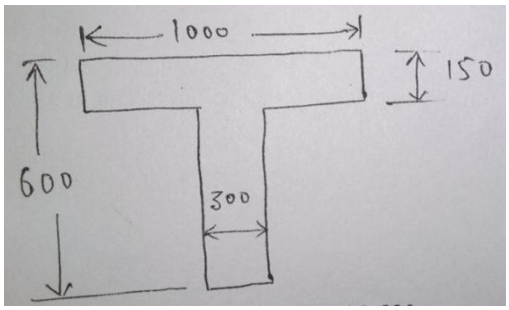
   Where X_u is depth of neutral axis, f_{ck} is cube strength of concrete

2. A reinforced concrete member is subjected to combined action of compressive aial force and bending moment. If ε_c is the least compressive strain in the member, f_y, the yield stress of steel and E_s, the modulus of elasticity of steel, the maximum permissible tensile strain in tension at the time of failure will be

   (a) $< 0.002 + \frac{f_y}{1.15\ E_s}$ (c) $= 0.002 + \frac{f_y}{1.15\ E_s}$

   (b) $> 0.002 + \frac{f_y}{1.15\ E_c}$ (d) 0.0035

3. An isolated T-beam is used as a walkway. The beam is fixed with an clear span of 6m. The effective width of flange, for the cross section shown in figure is



   (a) 812 mm (c) 820 mm

   (b) 815 mm (d) 825 mm

4. If the characteristic strength of concrete f_{ck} is defined as the strength below which not more than 95% of the test results are expected to fall, the expression for f_{ck} in terms of mean strength f_m and standard deviation S would be

   (a) $f_m - 0.1645\ S$ (c) f_m

   (b) $f_m - 0.645\ S$ (d) $f_m + 0.645\ S$

Common Data for question 5 and 6

A reinforced concrete beam of rectangular cross section of breadth 230 mm and effective depth 400 mm is subjected to a maximum factored shear force of 120 kN. The grades of concrete, main steel and stirrup steel are M 20, Fe 415, Fe 250 respectively. For the area of main steel provided, the design shear strength τ_c as per **IS 456: 2000** is 0.48 N/mm^2. The beam is designed for the collapse limit state.

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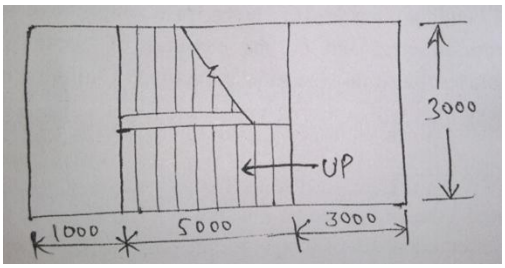
5. The spacing (mm) of legged 8 mm stirrups to be provided is
   (a) 40 (b) 115 (c) 250 (d) 400
6. In addition the beam is subjected to a torque whose factored value is 10.90 kN-m. The stirrups have to be provided to carry a shear (kN) equal to
   (a) 50.42 (c) 151.67
   (b) 130.56 (d) 200.23
7. The plan of stairs supported at each and by landing spanning parallel with risers is shown in figure. The effective span of staircase slab is



   (a) 7500 (c) 7000
   (b) 6000 (d) 6500
8. The minimum percentage tension reinforcement in a beam shall be greater than
   (a) $\frac{85}{f_y}$
   (b) $\frac{87}{f_y}$
   (c) 4
   (d) $\frac{46}{f_y}$
9. An RC short column with 300 mm X 300 mm square cross-section is made of M 20 grade concrete and has 4 numbers, 20 mm diameter longitudinal bars of Fe-415 steel. It is under the action of a concentric axial compressive load. Ignoring the reduction in the area of concrete due to steel bars, the ultimate axial load carrying capacity of the column is
   (a) 1201 kN (c) 1190 kN
   (b) 1195 kN (d) 1059 kN

10. An RC square footing of side length 2 m and uniform effective depth 200 mm is provided for a 300 mm X 300 mm column. The line of action of the vertical compressive load passes through the centroid of the footing as well as of the column. If the magnitude of the load is 320 kN, the nominal transverse (one way) shear stress in the footing is
    (a) 0.26 N/mm^2 (c) 0.34 N/mm^2
    (b) 0.30 N/mm^2 (d) 0.75 N/mm^2

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