Total No. of Questions : 6]

SEAT No. :

P505

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APR - 18/TE/Insem. - 104

T.E. (Civil)

STRUCTURAL DESIGN - II

(2015 Pattern) (Semester - II) (301010)

Time : 1 Hour] *[Max. Marks : 30*

Instructions to the candidates:

1) ***Answer Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6.***
2) ***Figures to the right indicate full marks.***
3) ***Use of IS 456-2000 and non programmable calculator is allowed.***
4) ***Neat diagrams must be drawn wherever necessary.***
5) ***Mere reproduction from IS Code as answer, will not be given full credit.***
6) ***Assume suitable data, if necessary.***

Q1) a) Compare behavior of concrete and steel with respect to working stress method (WSM) and limit state method(LSM). **[3]**

b) Draw stress strain diagram for singly reinforced balanced section as per WSM approach and derive the expressions for design constants for **[7]**

i) depth of netural axis $(k)_{bal}$,

ii) moment of resistance $(Q)_{bal}$;

iii) lever arm $(j)_{bal}$; and

iv) percentage steel $(pt)_{bal}$.

Evaluate these design constants for M 20 grade of concrete and Fe 415 grade of steel.

OR

Q2) a) Compare under-reinforced section with over-reinforced section with respect to LSM approach. **[3]**

b) Calculate the moment of resistance of a doubly reinforced RC beam of rectangular cross section of size 300 mm × 450 mm overall with 6 numbers of 20 mm ϕ bars on tension side and 4 numbers of 20 mm ϕ bars on compression side. Grade of concrete is M20 and steel grade is Fe 250. Effective covers for tension and compression reinforcement are 50 mm and 35 mm, respectively. Use WSM approach. **[7]**

P.T.O.

Q3) a) Determine the ultimate moment of resistance of a balanced reinforced section of 300 mm breadth and 600 mm effective depth using M25 concrete and Fe 415 steel. Also find the area of steel required to balance the section. **[4]**

b) Determine the ultimate moment of resistance of a L-beam for following data: Effective width of flange = 1200 mm; Depth of slab = 110 mm; Effective depth = 600 mm; Width of web = 300 mm; Area of tension reinforcement = 4 number of 25 mm diameter bars; Grade of concrete = M 20; Grade of steel = Fe 500. Use LSM approach. **[6]**

OR

Q4) a) Define doubly-reinforced section with neat sketch and enlist reason under which doubly-reinforced section becomes essential. **[3]**

b) Design a cantilever RC slab for an effective span of 1.25 m carrying live load of 2.75 kN/m^2 and floor finish of 1.0 kN/m^2. Use M20 grade of concrete and Fe 250 grade of steel. Show details of reinforcement. Use LSM approach. **[7]**

Q5) A RC slab is to be provided for a room measuring 5.8 m × 5 m size. The slab is supported at all four sides on 300 mm wide beam and its corners are prevented from lifting up as well as from twisting. Design the slab to carry a live load of 4 kN/m^2 and floor finish of 1 kN/m^2 using M20 grade of concrete and steel grade of Fe 500. Show details of reinforcement. Use LSM approach. **[10]**

OR

Q6) Design the first flight of a dog-legged staircase for a residential building with following data: **[10]**

a) Center line dimensions of staircase unit = 2.5 m × 4.5 m.

b) Floor to floor height = 3.2 m;

c) Live load = 3 kN/m^2 and Floor Finish = 1kN/m^2

d) Material: Concrete M 20 grade and steel Fe 415 grade

Show details of reinforcement. Use LSM approach.

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