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Total Pages—4

(Set-Q_1)

B.Tech-5th(Civil)
Structural Design

Full Marks : 70

Time : 3 hours

Q. No. 1 is compulsory and answer any **five** from the rest

The figures in the right-hand margin indicate marks

Relevant IS, Codes are permitted

Assume any necessary data

Usual notations have been used

1. Answer the following questions : 2 × 10

(*a*) Explain control of cracking in the limit state of serviceability.

(*b*) What do you mean by characteristics loads ?

(*c*) What are the partial safety factors for concrete and steel in the limitstate of collapse ?

(Turn Over)

(*d*) Determine the limiting moment of resistance of a style reinforced rectangular section of 300 mm width and 410 mm effective depth using M_{20} grade concrete.

(*e*) Write down the situations under which doubly reinforced beams become necessary.

(*f*) Determine the design shear strength of concrete Z_c for a R.C.C. T beam with 450 mm^2 of longitudinal reinforcement and effective depth of 42·5 mm. The width of flange is 1200 mm and that of web is 225 mm.

(*g*) Determine the design torsional moment M_t for a R.C.C. beam of overall depth 500 mm and width of 250 mm, when the torsion acting on the beam is 15 kNM.

(*h*) Calculate the design minimum eccentricity for a square column of size 300 × 300 mm with unsupported length of 3000 mm.

(*i*) A residential building has one two way slab and one one way slab of same short span length. Which slab will require more thickness and why ?

(*j*) How are the landing slabs designed in dog legged staircases ?

2. (*a*) Determine the main tension reinforcement required for a beam section with following data : 5

Size of beam = 300 mm × 600 mm, Factored moment = 170 KNM. Use M_{20} grade concrete and Fe415 grade steel.

(*b*) Design a single reinforce R.C.C. section for working load moments of 10 KNM (DL) and 40 KNM (LL) using M_{25} grade concrete and Fe415 steel. 5

3. Design a T-beam section of 300 mm rib width, 2000 mm flange width, 150 mm thickness of flange and 500 mm effective depth, when subjected to a ultimate moment of 1200 KNM. Use M_{20} and Fe415 steel. 10

4. A rectangular R.C.C. beam of 400 mm total depth and 250 mm wide is subjected to a twisting moment of 3 KNM in addition to a transverse shear of 60 kN. Calculate the longitudinal

reinforcement necessary using M_{20} concrete and Fe415 steel if the bending moment at the section is 25 KNM. 10

5. Design interior span of a two way slab for a panel 6 m by 7 m to the centres of supporting beams, 300 mm wide, total load on slab being 5 kN/m^2 including D.L. Use M_{20} concrete and Fe415 steel. 10

6. Design a square column section subjected ultimate axial load of 3000 kN. Use M_{20} concrete and Fe415 steel. 10

7. Design a dog-legged staircase with an intermediate landing 1200 mm width. The width of steps is 1000 mm, while the tread and riser are of 250 mm and 150 mm respectively. Each flight contain 10 number of steps. Use M_{20} concrete and Fe415 steel. 10

8. (*a*) What are various safety and serviceability requirements recommended in Indian standards ? 5

   (*b*) State the assumptions in case of limit state method of design of R.C.C. beams with sketches. 5