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ET-508(A)

B.Tech. Civil (Construction Management) /
B.Tech. Civil (Water Resources Engineering)

00258

Term-End Examination

June, 2014

ET-508(A) : STRUCTURAL DESIGN – I

Time : 3 hours *Maximum Marks : 70*

Note : *Attempt any **four** questions. Use of IS : 456 and scientific calculator is allowed. Any missing data may be assumed suitably and mentioned. Support your answers with neat sketches.*

1. (a) Describe the salient features of Limit State Design philosophy. $5\frac{1}{2}$

(b) For the beam section shown in Figure 1, determine *3+5+4*

(i) Neutral axis depth

(ii) Ultimate moment of resistance

(iii) Superimposed working live load which the beam of this section can carry over a simply supported span of 4 m.

Consider M-20 concrete, Fe-415 steel and use Limit-State method.

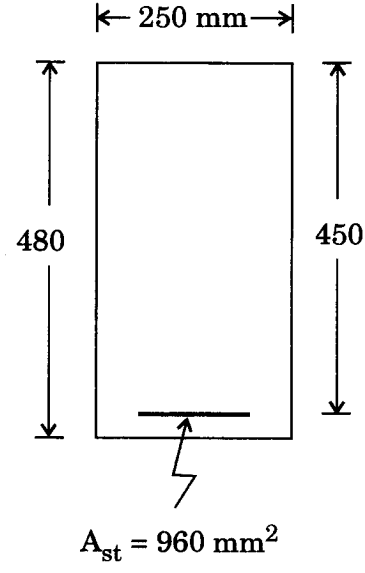

Figure 1

2. Design a one-way slab with a clear span of 3·5 m and simply supported on 200 mm wide supports. Take self weight of slab including weight of finish as 5.125 kN/m^2 and service live load as 4 kN/m^2.

Adopt M-20 concrete and Fe-415 steel and use Limit State Design method.

Draw neat sketches showing reinforcement detail. $17\frac{1}{2}$

3. (a) State the assumptions made in working stress method of design of R.C. members. $5\frac{1}{2}$

(b) An R.C. beam of rectangular section 250 mm wide by 500 mm overall depth is reinforced with 3 bars of 16 mm diameter on the tension side at an effective depth of 450 mm; and 2 bars of 16 mm diameter on the compression side with an effective cover of 50 mm. Estimate the moment of resistance of the section if M-15 grade of concrete and Fe-250 grade mild steel is used. Use working stress method. *12*

4. (a) Draw a neat longitudinal section of a typical two-span continuous R.C. beam showing details of reinforcement and curtailments as per I.S. code provisions. $5\frac{1}{2}$

(b) For the intermediate T-beam (shown in Figure 2) determine the following, if each beam is simply supported over effective spans of 4·2 m.

(i) Effective flange width

(ii) Depth of neutral axis

(iii) Ultimate moment of resistance *3+5+4*

Adopt M-20 concrete and Fe-415 steel and use Limit State Design method.

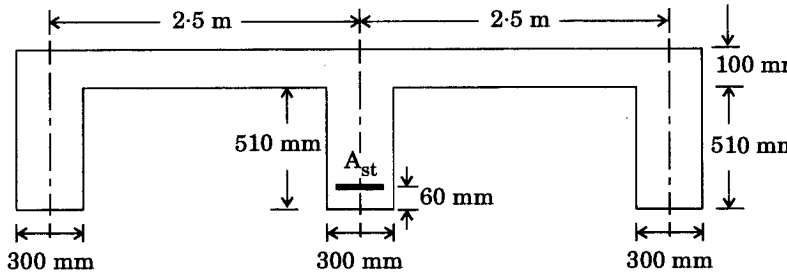

Figure 2

A_{st} = Area of tension steel = 3 – 22 Φ + 3 – 25 Φ

Grade of concrete = M-20, Grade of steel = Fe-415

5. (a) Determine the size of a combined rectangular footing and show the plan of footing along with location of two columns to be supported by this footing. The columns' (C_1 and C_2) details are as below :

(1) Size C_1 : 300 × 300 mm C_2 : 300 × 300 mm

(2) Service load on column

(i) Dead load C_1 : 480 kN C_2 : 610 kN

(ii) Live load C_1 : 170 kN C_2 : 190 kN

The width of footing to be kept as 2·0 m. Safe bearing capacity of soil = 175 kN/m^2. Arrange the footing plan in order to ensure uniform upward pressure. *8*

(b) Determine and provide longitudinal reinforcement and lateral ties in a column (300 × 600 mm) which is subjected to ultimate axial load of 2000 kN. Adopt M-20 concrete and Fe-415 steel and use Limit State Design. Show the details of reinforcement through neat sketch. $7\frac{1}{2}+2$

6. (a) Calculate the "ultimate shear strength" of the support section of a beam shown in Figure 3 by using Limit State Design. $5\frac{1}{2}$

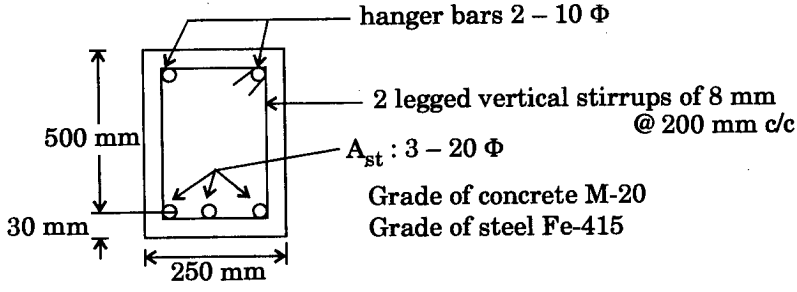

Figure 3

(b) How do the following parameters affect the bond strength of an R.C. section ? Discuss for any ***four*** of the following : *12*

(i) Diameter of main tension reinforcement

(ii) Nature of force in main reinforcement i.e. tension or compression

(iii) Amount of reinforcement at a section

(iv) Type of reinforcement

(v) Hooks/bends in reinforcement bars

7. A reinforced concrete dome of 6 m base diameter with a rise of 1·25 m is to be designed for a water tank. The uniformly distributed load (including dead load, self weight and live load) may be taken as 4·4 kN/m^2. Adopt M-20 concrete and Grade-I steel with permissible tensile stress (σ_{st}) as 100 N/mm^2. $17\frac{1}{2}$
