TED (15) – 6013

(REVISION — 2015)

Reg. No. ....

Signature ....

DIPLOMA EXAMINATION IN ENGINEERING/TECHNOLOGY/ MANAGEMENT/COMMERCIAL PRACTICE — APRIL, 2019

STRUCTURAL DESIGN - II

[*Time* : 3 hours

(Maximum marks : 100)

[*Note* :— Use of IS 800-2007, IS 875, IS 1905 and steel tables are permitted.]

PART — A

(Maximum marks : 10)

Marks

I Answer *all* questions in one or two sentences. Each question carries 2 marks.

1. Define gauge distance of the bolt.
2. Differentiate between column and strut.
3. What is the slenderness ratio in compression member ?
4. Differentiate between simple beam and compound beam.
5. What are the two type of members in a truss based on stress ? $(5 \times 2 = 10)$

PART — B

(Maximum marks : 30)

II Answer any *five* of the following questions. Each question carries 6 marks.

1. What are the common steel structures ?
2. What are the advantages and disadvantages of bolted connections ?
3. Write the codal provisions for battened system.
4. An ISLB 600 @ 995N/m carrying a live load of 20 kn/m including self weight over an effective span of 5m, the yield stress is 250mpa. Check the safety of beam in deflection.
5. Sketch the crossection of a plate Girder and mark the components.
6. What are the different types of loads acting on a roof truss ?
7. Explain the terms effective length and effective height of masonry wall. $(5 \times 6 = 30)$

Marks

PART — C

(Maximum marks : 60)

(Answer *one* full question from each unit. Each full question carries 15 marks.)

Unit — I

III (a) Calculate the design strength of welded joint. If the size of weld is 6mm and its length is 240mm, the ultimate stress in the weld is 410mpa. Assume the condition are made in the workshop. 8

(b) What are the type of loads and load conditions in the design of steel structure ? 7

Or

IV (a) A tie member of a truss consisting of an angle section ISA 65 × 65 × 6 of Fe410 Grade is welded to an 8mm gusset plate. Design a weld to transmit a load equal to the full strength of the member. Assume shop welding. 10

(b) What are the physical and mechanical properties of steel structures ? 5

Unit — II

V (a) A single angle ISA 200 × 100 × 15 mm is connected to a Gusset plate of 12 mm thick by fillet weld 4 mm size. Determine the design strength with fy = 300N/mm^2, fu = 400N/mm^2 and length of weld is 240mm. 9

(b) What are the different modes of failure of tension member ? 6

Or

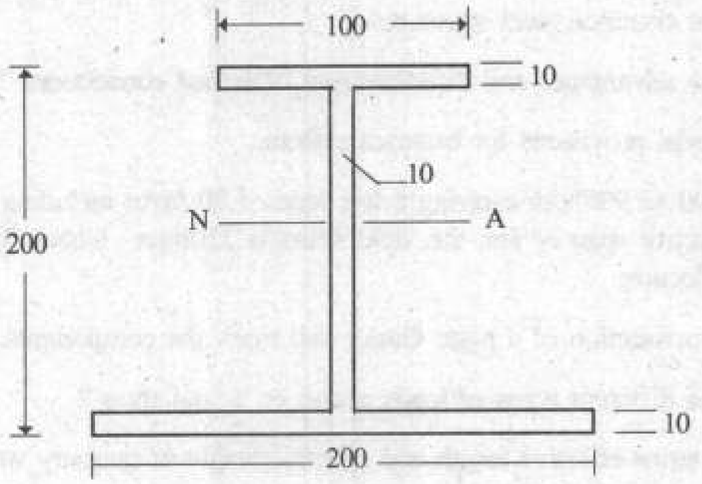
VI (a) Design a single angle strut connected to the gusset plate to carry 180KN factored load. The length of the strut between centre to centre connection is 3m. 8

(b) Determine the design axial load on the column section ISMB350, given that the height of coloumn is 3.0m and that it is pin - ended. Also assume the following fy = 250mpa, fu = 410mpa, E = 2 × 10^5 mpa. 7

Unit — III

VII (a) Determine the plastic moment capacity and plastic section Modulus of a rectangular beam section of size b × d about z – z axis. 7

(b) Determine the plastic moment capacity and plastic modulus of section of the Unsymmetric section shown in figure.



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Or

Marks

VIII (a) Design a simply supported laterally restrained beam of span 5m carrying an UD load of 20KN/m imposed load and 20KN/m dead load. Assume Fe410 Grade. 10

(b) What is the difference between laterally restrained and unrestrained beam ? 5

UNIT — IV

IX (a) Determine the design loads on roof truss for a factory building for a span 20m, pitch = 1/5 and the height of truss at eve's level is 10m, the spacing of truss is 4.5m, the factory building is 36m long is located at Delhi, provide A C sheeting. 10

(b) Differentiate between partition wall and panel wall. 5

OR

X (a) A masonry wall carry an axial load of 9.8 KN/m is of 3.5m effective length. It is not braced by crosswalls. The effective height of the wall is 2.40m. Design the Masonry wall. 9

(b) Write short notes on :

(i) Pitch of Trusses

(ii) Spacing of Trusses

(iii) Pur lins 6

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STRUCTURAL DESIGN - II

QN No	SCORING INDICATORS	Split Score	Total Score
I 1	It is the distance between the two consecutive bolts of adjacent rows and is measured at right angles to the direction of load.	2	
2	The vertical compression members in a building supporting floors are called columns. The compression members used in roof truss and bracings are called struts.	2	
3	It is the ratio of effective length to corresponding radius of gyration of the section.	2	
4	A simple beam, in which carry light load of single beam section is used. A compound beam, in which carry heavy load of builtup section with cover plates are used.	2	
5	Struts and Tie. Strut is a compression member. tie is a tension member.	2	
	PART - B		
II 1	Rolled Steel I Sections, Rolled Steel Channel Section. RS angle Sections, RS tee Section, RS steel bars, RS tubes, RS plates, RS strips, RS flats.	2	
	a) RS I - Section - ISJB, ISLB, ISMB, ISWB, ISHB		
	b RS Channel Section - ISJC, ISLC, ISMC, ISSC		
	c, RS angle Section - IS equal angle, IS unequal angle (ISA)	4	6
	d, RS Tee Section - ISNT, ISHT, ISLT, ISLT, IS ST		

2. Advantages 2

a) Making joint is noiseless

b) Donot need skilled Labour Ans3

c) Needs less Labour (3)

d) Connections can be made quickly

e) Alterations, if any, can be done easily.

Disadvantages

a) Tensile Strength is reduced considerably due to stress concentration and reduces of area

b) Rigidity of joints is reduced due to loose fit, resulting into excessive deflections. (3) 6

c) Due to vibrations nuts likely to loosen endangering the safety of the structures.

3. a) Batten plates should be provided symmetrically.

b) At both ends batten plates should be provided. They should be provided at points where the member is stayed in its length.

c) Battens shall be of plates, angles, channels etc. and at their ends shall be welded or bolted.

d) The effective slenderness ratio of battened columns shall be taken as 1.1 times the max. actual SR of column.

e) Battens shall be designed to carry the BM and SF arising from transverse SF V_t equal to 2.5% of the total axial force. 6

f) The design shear and moments for batten are

$$V_b = \frac{V_t C}{NS} \quad \text{and} \quad M = \frac{V_t C}{2N} \text{ at each connection.}$$

 3

4) Live load = 20 kN/m, Dead Load = 0.995 kN/m.

Total Load = DL + LL = 20 + 0.995 = 20.995 1

for ISLB 600, I_{xx} = 72886.7.6 × 10^4

Deflection, $\delta_{max} = \frac{5}{384} \frac{w l^4}{EI}$ 1

$= \frac{5}{384} \frac{20.995 \times 5000^4}{2\times10^5 \times 72886.7.6\times10^4}$ 2

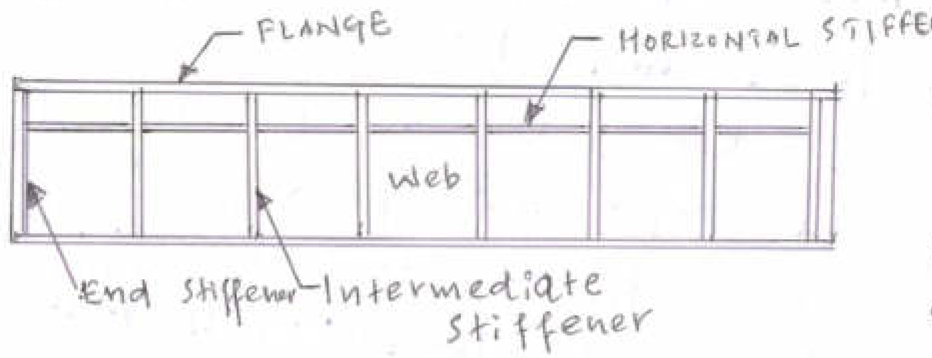
= 1.172 mm.

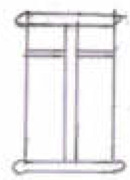
Permissible deflection for Simply Supported = $\frac{l}{240}$ 2 6

$\delta_{per} = \frac{5000}{240}$ = 20.83 mm

1.172 < 20.83 . Hence the Given beam is Safe against deflection.

5)





Cross Secn LS-4 CS-2 6

6) Dead load, imposed loads, Wind loads, etc. 2
Other loads.

a) Dead loads - It includes the weight of Sheeting, purlins, bracings, self weight etc.

b) Live load (Imposed Load) - As per IS 875 part II. 4

Up to 10° slope - 0.75 kN/m² 6

for more than 10° slope - 0.75 - 0.02(θ-10) where θ is the slope of sheeting. 4

However a minimum of $0.4 \, kN/m^2$ shall be considered.

c) Wind Load

IS 875 part 3 gives the following steps.

a) Determine basic wind speed

b) Obtain design wind speed

c) calculate design wind pressure

d) Calculate wind pressure on roof.

7) a) Effective length of wall

It is used in the calculation of slenderness Ratio depends upon the length of the wall between centres of cross wall, pier etc. and support conditions. It varies $0.8L$ to $2L$ 3 and it is given in table 5 of IS 1905.

b) Effective height of wall

It is to be used for calculating the slenderness Ratio, is the function of the actual height (H) of the wall and the conditions of lateral support. Eff. height (h) varies from $0.75H$ to $1.5H$ depending on the lateral support conditions and it is given in table (4) of IS 1905 3 6

Part. C

III a) Size of weld $= s = 6\,mm$, Length of weld $= 240\,mm$

$f_u = 410 \, N/mm^2$, 3

Throat thickness, $t = 0.7 \times$ size of weld

$= 0.7 \times 6 = 4.2\,mm$.

Since it is shop weld, $\gamma_{mw} = 1.25$ 1(5)

Design strength of weld = $\dfrac{L_w \cdot t \cdot f_u/\sqrt{3}}{\gamma_{mw}}$ 2

$= \dfrac{240 \times 4.2 \times 410/\sqrt{3}}{1.25} = \underline{190.89 \text{ kN}}$ 2 8

b) As per page No. 16, IS 800-2007

Load Combinations for design purposes shall be those such that produce maximum forces and effects and consequently maximum stresses and deformations.

The various loads and its combinations are as follows:

Dead load, live load, wind load, Earthquake load, Erection load, Accidental load. 2

a) dead load + live load

b) Dead load + live load + Earthquake load. 4 6

c) Dead load + wind load

d) Dead load + Erection load.

IV a) from steel table, the properties of ISA 65 x 65 x 6 are

$A = 744 \text{ mm}^2$, $C_z = 18.1 \text{ mm}$.

Tensile Capacity of the member $= 744 \times 250/1.1$ 1

$= 169.1 \text{ kN}$

The force resisted by the weld at the lower side of the angle

$P_1 = 169.1 \times (65 - 18.1)/65 = 122.01 \text{ kN}$ 2

force to be resisted by the upper side of the angle

$P_2 = 169.1 \times 18.1/65 = 47.09 \text{ kN}$ 2

Assuming a weld size of 4mm. (6)

Effective throat thickness of weld = $0.7 \times 4 = 2.8$ mm

Strength of the weld $= 2.8 \times 410 / (\sqrt{3} \times 1.25)$ 1

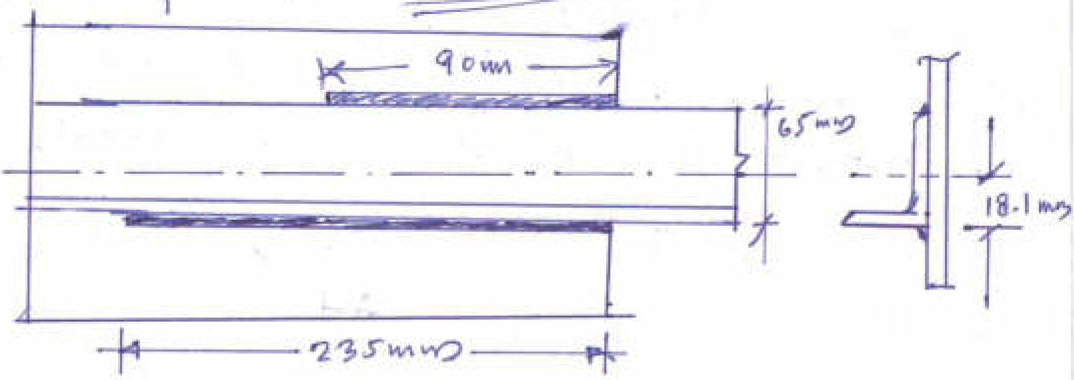
$= 530$ N/mm

$L_{w1} = 122.01 \times 10^3 / 530 = 230.1$ mm 2

Hence provide 235 mm at the bottom.

$L_{w2} = 47.09 \times 10^3 / 530 = 88.8$ mm. 2

Hence provide 90 mm at the top.



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IV b) Physical properties of steel

1. Density
2. Modulus of Elasticity
3. poisson's ratio 3
4. Modulus of Rigidity
5. Coefficient of thermal expansion

Mechanical properties of Steel

1. Yield stress
2. Ultimate stress. 2 5
3. percentage of elongation.

UNIT - II

V a) Properties of ISA 200×100×15 mm.

$A_g = 4278$ mm^2

Size of weld = 4mm, $f_y = 300$ mpa, $f_u = 440$ mpa.

<u>Design strength due to yielding of Gusset</u>

$$T_{dg} = \cancel{4278} \cdot \frac{A_g f_y}{\gamma_{m0}}$$

2

$$= \frac{4278 \times 300}{1.1} = \underline{1166.7 \text{ kN}}$$

<u>Design strength due to rupture</u>

$$T_{dn} = \frac{0.9 A_{nc} \cdot f_u}{\gamma_{m1}} + \frac{\beta A_{go} f_y}{\gamma_{m0}}$$

where $\beta = 1.4 - 0.076\left(\frac{w}{t}\right)\left(\frac{f_y}{f_u}\right)\left(\frac{b_s}{L_c}\right)$

$$\beta = 1.4 - 0.076\left(\frac{100}{15}\right)\left(\frac{300}{440}\right)\left(\frac{100}{240}\right)$$

$$= 1.256.$$

$A_{nc} = \left[L - t/2\right]t = \left[200 - 15/2\right]15 = 2887.5 \text{ mm}^2$

$A_{go} = \left[b - t/2\right]t = \left[100 - 15/2\right]15$

$$= \underline{1387.5 \text{ mm}^2}$$

(3)

$$T_{dn} = \frac{0.9 \times 2887.5 \times 440}{1.25} + \frac{1.256 \times 1387.5 \times 300}{1.1}$$

$$= \underline{1390.04 \text{ kN}}$$

<u>Design strength due to block shear</u>

$$T_{db1} = \left[\frac{A_{vg} f_y}{\sqrt{3}\,\gamma_{m0}} + \frac{0.9 A_{tn} f_y}{\gamma_{m1}}\right]$$

$$T_{db2} = \left[\frac{0.9\,A_{vn}\cdot f_u}{\sqrt{3}\,\gamma_{m1}} + \frac{A_{tg}\,f_y}{\gamma_{m0}}\right]$$ (8)

$A_{vg} = A_{vn} = 240 \times 2 \times 4 = 1920\,mm^2$

$A_{tg} = A_{tn} = 200 \times 2 \times 4 = 1600\,mm^2$

$$T_{db1} = \left[\frac{1920 \times 300}{\sqrt{3} \times 1.1} + \frac{0.9 \times 1600 \times 440}{1.25}\right]$$

$= \underline{\underline{809.2\,kN}}$

$$T_{db2} = \left[\frac{0.9 \times 1920 \times 440}{\sqrt{3} \times 1.25} + \frac{1600 \times 300}{1.1}\right]$$ (3)

$= \underline{\underline{787.53\,kN}}$

Strength of member is the least of

1166.7, 1390.04, 809.2, 787.53. (1) 9

i.e. $= \underline{\underline{787.53\,kN}}$

VI b) 1. Yielding of Gross Section (page no. 33 and 34 of IS 800-2007)

2. Rupture

3. Block Shear

1. Design strength due to yielding of Gross Section

$T_{dg} = \dfrac{A_g f_y}{\gamma_{m0}}$ where A_g = Gross area of angle

f_y = Yield Stress,

γ_{m0} = Partial Safety factor = 1.1

2. Design Strength due to Rupture.

$$T_{dn} = \frac{0.9\,A_{nc}\,f_u}{\gamma_{m1}} + \frac{\beta\,A_{go}\,f_y}{\gamma_{m0}}$$

where $\beta = 1.4 - 0.076\left(\frac{w}{t}\right)\left(\frac{f_y}{f_u}\right)\left(\frac{b_s}{L_c}\right)$

Anc = Net area of connected leg

3. Design Strength due to Block Shear

Block shear strength is the least of two

$$T_{db1} = \frac{A_{vg} f_y}{\sqrt{3}\,\gamma_{m0}} + \frac{0.9 A_{tn} f_u}{\gamma_{m1}}$$

$$T_{db2} = \frac{0.9 A_{vn} f_u}{\sqrt{3}\,\gamma_{m1}} + \frac{A_{tg} \cdot f_y}{\gamma_{m0}}$$

where A_{vg} and A_{vn} = Minimum Gross ~~area~~ and net area in shear

A_{tg} and A_{tn} = Minimum Gross and net area in tension. 3×2 6

VI a) Assume $f_{cd} = 90$ mpa.

$$A = \frac{180 \times 10^3}{90} = 2000 \text{ mm}^2$$

Try ISA ~~90×90×12mm~~ 130×130×8 mm which has $A = \cancel{2019 \text{ mm}^2}$ 2022 mm² (2)

$r_{min} > r_{vv} = \cancel{17.4 \text{ mm}}$ 25.5 mm

Assume the strut will be connected to the Gusset plate with at least 2 bolts. (2)

$KL = 0.85L = 0.85 \times 3000 = 2550$ mm (2)

$$KL/r = \frac{2550}{\cancel{17.4}\ 25.5} = \cancel{146.55}\ 100$$

From table 9(c), for $KL/r = 100$, $f_{cd} = 107$ mpa

$$P_{cd} = 2022 \times 107 = 216354 > 180000 \text{ N}$$ (2) 8

Provide ISA 130×130×8 mm

VI (b) For ISMB 350, (10)

$h = 350$, $b_f = 140$, $t_f = 14.2$, $t_w = 8.1$ mm

$I_{zz} = 13630.3 \times 10^4$ mm^4, $I_{yy} = 537.7 \times 10^4$ mm^4

$A = 6671$ mm^2. $r_{min} = 28.4$ mm

Assume ~~Column belongs to buckling class - c~~

Section ~~properties~~

Design Compression stress (f_{cd})

$$f_{cd} = \frac{[f_y/\gamma_{m0}]}{\phi + [\phi^2 - \lambda^2]^{1/2}}$$

slenderness Ratio, $\lambda = \frac{KL}{r_{min}} = \frac{3000}{\cancel{51.47}\ 28.4} = 105.63$

Eulers Buckling class, $f_{cc} = \frac{\pi^2 E}{(KL/r_{min})^2} = \frac{\pi^2 \times 2\times 10^5}{(105.63)^2}$

$= 176.73$ N/mm^2

Constant 'λ' $= \sqrt{f_y/f_{cc}} = \sqrt{\frac{250}{176.73}} = \underline{1.19}$ 1

Imperfection factor (α)

$\frac{h}{b_f} = \frac{350}{140} = 2.5$, $t_f = 14.2 < 40$ mm.

Refer Page No. 44, Table No. 10.

$\frac{h}{b_f} = 2.5$, $t_f = 14.2 < 40$.

Buckling axis and Buckling Class wise

$z-z \rightarrow a$

$y-y \rightarrow b$

Then values 'a' and 'b' are obtained from table no. 7.

$a = 0.21, \quad b = 0.34$

CONSTANT Φ

$\Phi_z \rightarrow z\text{-}z \rightarrow a \rightarrow 0.21 \rightarrow \alpha.$

$\Phi_y \rightarrow y\text{-}y \rightarrow b \rightarrow 0.34 \rightarrow \alpha.$

$$\phi_z = 0.5\left[1 + \alpha_z(\lambda - 0.2) + \lambda^2\right]$$

$$= 0.5\left[1 + 0.21(1.19 - 0.2) + 1.19^2\right]$$

$$= 2.62$$

(2)

$$\phi_y = 0.5\left[1 + \alpha_y(\lambda - 0.2) + \lambda^2\right]$$

$$= 0.5\left[1 + 0.34(1.19 - 0.2) + 1.19^2\right]$$

$$= 2.75$$

Design Compressive Stress $(f_{cd})_z = \dfrac{(f_y/\gamma_{m0})}{\phi_z + \left[\phi_z^2 - \lambda^2\right]^{1/2}}$

$$f_{cd_z} = \frac{\frac{250}{1.1}}{2.62 + \left[2.62^2 - 1.19^2\right]^{1/2}} = 45.91 \text{ N/mm}^2$$

$$f_{cd_y} = \frac{250/1.1}{2.75 + \left[2.75^2 - 1.19^2\right]^{1/2}} = 43.46 \text{ N/mm}^2$$ (2)

$f_{cd\,min} = 43.46 \text{ N/mm}^2$

Design Strength $(P_d) = A_e f_{cd\,min} = 6671 \times 43.46$

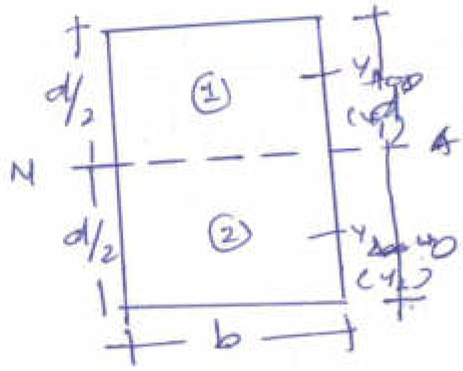
$= 289.92 \text{ kN}$ (2) 7

UNIT-III

12

III a)

$A = \text{area} = bd.$



$\bar{y}_1 = \bar{y}_2 = \frac{d}{4}$

$Z_p = \frac{A}{2}(\bar{y}_1 + \bar{y}_2)$

$= \frac{bd}{2}(d/4 + d/4)$

$= \frac{bd^2}{4}$

Plastic moment Capacity $(M_p) = Z_p . f_y$ 7

$= \frac{bd^2}{4} . f_y$

b) Total area $= 100\times10 + 200\times10 + (200-20)\times10$

$= 4800 \text{ mm}^2$ (1)

$A_c = A_t = \frac{4800}{2} = 2400 \text{ mm}^2$

plastic N.A is at a depth 'h' from top fibre where h is given by

$100\times10 + (h-10)\times10 = 2400$ (2)

$\therefore h = 150 \text{ mm}$

Taking moment of all comp and tensile force about N.A

$M_p = \left[100\times10(150-5) + 10(150-10)\frac{(150-10)}{2} + 10(50-10)\frac{(50-10)}{2} + 200\times10(50-5)\right] f_y$ (4)

$= 331000 \, f_y . \text{mm}^2$

$Z_p = \frac{M_p}{f_y} = 331000 \text{ mm}^3$ (1)

8

(13)

VIII (a) Load Calculations

Dead load = 1.5 × 20 = 30 kN/m

Live load = 1.5 × 20 = 30 kN/m. (1)

60 kN/m

Maximum Bending Moment = $\frac{60 \times 5^2}{8} = 187.5$ kNm

Z_p reqd = $\frac{M \gamma_{mo}}{f_y} = \frac{187.5 \times 10^6 \times 1.1}{250}$ (1)

$= 825 \times 10^3$ mm^3

Choose a trial Section - ISLB 350 @ 0.486 kN/m

Properties - h = 350, B = 165, t_f = 11.4, t_w = 7.4

Depth of web (d) = $h - 2(t_f + R)$ =

$= 350 - 2(11.4 - 16) = 295.2$ mm

$I_{zz} = 13200 \times 10^4$ mm^4, $Z_e = 751.9 \times 10^3$ mm^3

$Z_p = 851.11 \times 10^3$ mm^3

Section classification

$\varepsilon = \sqrt{\frac{250}{f_y}} = \sqrt{\frac{250}{250}} = 1$ (outstanding) $b = 165/2 = 82.5$

$\frac{b}{t_f} = \frac{82.5}{11.4} = 7.23 < 9.4$

(2)

$\frac{d}{t_w} = \frac{295.2}{7.4} = 39.9 < 84$

Hence the Section is classified as plastic Section.

Check for Shear Strength.

Design Shear, $V = \frac{wl}{2} = \frac{60 \times 5}{2} = 150$ kN.

Design Shear Strength of Section, $V_d = \frac{f_y}{\sqrt{3}} \times \frac{1}{1.1} \times$ Shear area

$$V_d = \frac{250}{\sqrt{3}} \times \frac{1}{1.1} \times 350 \times 7.4$$ (14)

$$= 340\,kN > 150\,kN.$$

(2)

$0.6V_d = 204$

therefore, design shear force $V < 0.6V_d$.

Check the moment capacity of section

$\frac{d}{t_w} = 39.9 < 67\varepsilon$

Hence $M_d = \beta_b Z_p \cdot \frac{f_y}{\gamma_{m0}}$

$\beta_b = 1.0$, Since it is a plastic section. (2)

$$M_d = 1 \times \frac{851.11 \times 10^3 \times 250}{1.1} = 193.43\,kNm > 187.5$$

Hence ok.

Check for deflection

$$\delta = \frac{5}{384} \cdot \frac{wl^4}{EI} = \frac{5 \times 20 \times 5000^4}{384 \times 2 \times 10^5 \times 13200 \times 10^4}$$

(2)

$= 6.165\,mm$.

Allowable Max. deflection $= \frac{L}{300} = \frac{5000}{300} = 16.6\,mm$

Deflection less than the allowable max. deflection ok. (10)

VIII (b) If the compression flange of the beam is laterally supported by flooring, is called laterally supported beams.
If the compression flange of beam is not laterally supported, is called laterally unsupported beams. In this type, the lateral buckling

(15)

of the Compression flange reduces the load carrying capacity of the beam. $2 \times 2\frac{1}{2}$ 5

IX, a. Basic wind speed 'V_b' for Delhi is 47m/s. (from Appendix 'A' of IS 875-1987 Part-3.

Dead load calcns

Self wt. AC. Sheet = 200 N/M^2

" Purlin = 100 N/M^2

" Bracings = 20 N/M^2

Self wt. of Truss $= 10\left[\frac{L}{3}+5\right]\frac{S}{4}$

$= 10\left[\frac{20}{3}+5\right]\frac{4.5}{4} = 131.25$ N/M^2

Total dead load = 451.25 N/M^2.

Rise = $\frac{1}{5} \times 20$ = 4 m., $\tan\theta = \frac{\text{Rise}}{\text{Half span}}$

$\tan\theta = \frac{4}{10}$ $\theta = \tan^{-1} 0.4 = 21.8°$

Live load on Roof = 750 — $(\theta - 10)$ 20

= 750 — (21.8 — 10) 20 = 513.97 N/M^2 2

Live load on Truss = $\frac{2}{3}$ LL = $\frac{2}{3} \times 513.97$

= 342.64 N/M^2.

Internal pressure Coefficient. [C_{pe}]:

$\frac{h}{w} = \frac{\text{height of eve's level}}{\text{Span}} = \frac{10}{20} = 0.5$

$\frac{h}{w} = 0.5$ and slope is 21.8° 2

from table No. 5, IS 875—1987

Wind angle 0°		Wind angle 90°	
Wind ward side (EF)	Lee ward side (GH)	Wind ward side (EG)	Lee ward side (FH)
30 → 0 20 → 0.4 10 → -0.4 1 → -0.04	$C_{pe} = 0.4$	$C_{pe} = -0.7$	$C_{pe} = -0.6$

For 1.8°, $1.8 \times 1 \rightarrow 1.8 \times (-0.04)$. 2

$1.8 \rightarrow -0.072$, $C_{pe} \rightarrow (20 + 1.8)$

$= 0.4 - 0.072$

$= +0.328$

C_{pe} is the minimum of above four values

$C_{pe} = -0.7$.

$V_z = k_1 k_2 k_3 V_b = 1 \times 0.88 \times 1 \times 47$

$= 41.36$ m/s. 2

Design wind pressure

$P_d = 0.6 V_z^2 = 0.6 \times 41.36^2 = 1026.38$

Assuming permeability medium, $C_{pi} = \pm 0.5$

$C_{pe} = -0.7$

$C_{pe} - C_{pi} = -0.7 - (0.5) = -1.2$

$C_{pe} - C_{pi} = -0.7 - (-0.5) = -0.2$

Minimum is -1.2

Wind load, $F = [C_{pe} - C_{pi}]\, A\, p_d$

$= -1.2 \times 1026.38$

$= \underline{1231.65 \text{ N/m}^2}$ 2 (10)

(17)

IX b. partition wall

An interior non-load bearing wall, one storey or part storey in height.

Panel wall

An exterior non-load bearing wall in framed construction, wholly supported at each storey but subjected to lateral loads. 5

X a. Assume wall thickness = 200mm.

Slenderness Ratio = $\frac{\text{Eff. height}}{\text{Eff. thickness}} = \frac{2400}{200} = 12$ (1)

Assume CM 1:5 (M1 Grade) and brick having Comp. Strength = 5 N/mm², Basic Comp. Stress in Masonry from table (8) of IS 1905 is $f_b = 0.5$ mpa

Area of wall = A = 3.5 × 0.2 = 0.70 m² > 0.2 m² (2)

Hence No Size Reduction factor is needed, $k_a = 1$

From table (9) of IS:1905, for SR = 14 and zero eccentricity, Stress Reduction factor, $k_s = 0.84$

Assuming height to width ratio of unit as 1.0. the Shape Modification factor for Brick of crushing strength 5 mpa is $k_p = 1.2$ (Table 10 of IS 1905) (3)

Permissible Comp. Stress = $f_c = k_a \cdot k_s \cdot k_p \cdot f_b$

$= 1 \times 0.84 \times 1.2 \times 0.5 = 0.504$ mpa

Actual Comp. Stress = $f = P/A = \frac{9800}{1000 \times 200} = 0.049$ mpa < 0.504

Hence OK

Hence provide 200mm thick Brick wall with Bricks of comp. strength of 5 mpa and use M1 Grade Mortar. (3) (9)

X b. Pitch of Trusses

It is defined as the ratio of height of the truss to the span. A minimum pitch of 1/6 for GI sheet and 1/12 for AC sheet.

Spacing of Trusses

The distance between two consecutive trusses is called spacing of truss. The spacing of trusses is governed by the spacing of trusses is governed by the size of space to be covered by roof. ~~As~~

~~the spacing~~

PURLINS

A Roof beam, usually supported by Roof trusses. It should be located on Panel points of top chord members. Generally the spacing of purlins varies from 1.35m to 2.0m.

3x2 6

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