L-3/T-2/ARCH **Date : 17/07/2016**

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-3/T-2 B. Arch. Examinations 2014-2015

Sub : **ARCH 353** (Urban Design-I)

Full Marks: 140 Time : 3 Hours

USE SEPARATE SCRIPTS FOR EACH SECTION

The figures in the margin indicate full marks.

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## SECTION – A

There are **FOUR** questions in this section. Answer Q. No. 1 and any **TWO** from the rest.

1. Write short note on any two of the following: **(10×2=20)**
   (a) Elements of Urban Design
   (b) Principles of Urban Mass Design
   (c) Unity in Urban Design.

2. (a) What is meant by 'Scale' in Urban Design? What types of scale are used in Urban Design? Discuss with examples. **(15)**
   (b) How circulation is related to Urban Scale? **(10)**

3. (a) Define 'Urban Space'. What are three main elements of urban space structure? Discuss. **(10)**
   (b) What are the various types of "Urban Squares"? Discuss their characteristics and state their specific purposes. **(15)**

4. (a) Define "Order". How geometric order is different from urban order? **(10)**
   (b) How "Order" can be achieved in Urban Design? Discuss with examples. **(15)**

## SECTION – B

There are **FOUR** questions in this section. Answer Q. No. 5 and any **TWO** from the rest.

5. Write short note on any two of the following: **(10×2=20)**
   (a) Concept of Citta Nouva
   (b) Characteristics of Medieval Cities
   (c) Organizing principle of Republican Forum, Rome

6. (a) Describe Urban Design. What are the objectives of Urban Design? **(5)**
   (b) Differentiate the role of Urban Designer and that of Urban Planner. **(5)**
   (c) What are the different levels of Urban Design? Discuss with examples. **(15)**

7. (a) Describe the Urban Design ideas developed in the Remodeling project of Campidoglio, Rome by Michelangelo during the Renaissance period. **(20)**
   (b) Urban Design Vision of Leonardo da Vinci. **(5)**

8. (a) What was the Urban Design Principle of Acropolis, Athens? **(10)**
   (b) Describe the Evolution of Agora in Athens. **(15)**

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**L-3/T-2/ARCH** **Date : 23/07/2016**

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-3/T-2 B. Arch. Examinations 2014-2015

Sub : **EEE 373** (Building Services III - Electrical)

Full Marks: 140 Time : 3 Hours

USE SEPARATE SCRIPTS FOR EACH SECTION

The figures in the margin indicate full marks.

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## SECTION – A

There are **FOUR** questions in this section. Answer any **THREE**.

1. (a) If a sinusoidal current, $i = \text{Im} \sin wt$ flows through a series circuit consisting of a resistive element R and an inductive element L, then **(7+8)**

   (i) Find the applied voltage, v.

   (ii) Find the instantaneous power, p.

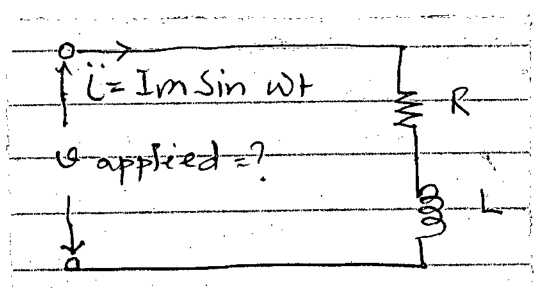


Fig. for Q 1 (a)

(b) Prove that the maximum amount of energy stored by a pure inductor L is $\left(\frac{L\,\text{Im}^2}{2}\right)$, where Im is the maximum current passing through the inductor. **($8\frac{1}{3}$)**

2. (a) What are the different types of electrical wiring-systems in our country? With simple diagram explain any 5 (five) of them in brief. **(11)**

   (b) What are the main reasons to install "Lightning Protection System" for a high-rise building? Draw a Roof-Plan of a big high-rise building and show the "Lightning Protection System" of that building. **($12\frac{1}{3}$)**

3. (a) In view of Electrical Safety Measures, describe in-brief on "Safety of Men and Machines/Equipment". **(11)**

   (b) What are the reasons to provide "Earth Continuity Conductors (ECCs)" in different big electrical installations? With simple drawings/diagrams, show in-details the installation of ECC, Earthing-Lead and Main Earthing (Plat or Pipe) System Design. **($12\frac{1}{3}$)**

Contd .......... P/2

**EEE 373**

4. (a) (i) Draw a 3 (three) bed room (with attached bath) modern house with other rooms and spaces. **(19)**

(ii) Show the Electrical Fittings and Fixtures in your above designed house.

(iii) Mention, in-brief, the Legends of the Fittings and Fixtures that you have used in your design.

(b) In very-brief, explain the reasons behind providing/fixing of the different types of fittings and fixtures in the above design. **($4\frac{1}{3}$)**

## SECTION – B

There are **FOUR** questions in this section. Answer any **THREE**.

All the symbols and notations used in this section have their usual meaning.

5. (a) Find value of $I_0$ and $I_1$ for the circuit shown in the Fig. for Q. No. 5(a). **(10)**

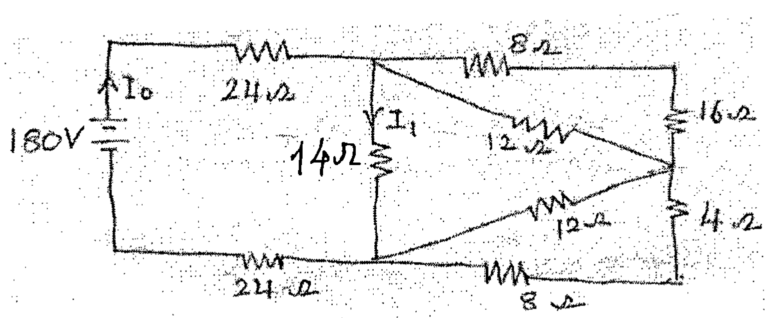


**Fig. for Q. No. 5(a)**

(b) Using Delta-Wye (Δ-Y) transformation find the current $I_0$ for the circuit shown in the Fig. for Q. No. 5(b). **($13\frac{1}{3}$)**

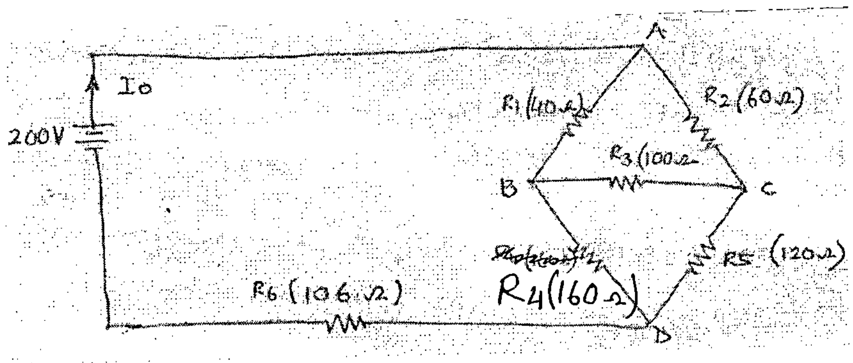


**Fig. for Q. No. 5(b)**

**EEE 373**

6. (a) Using Branch Current Method, find the currents in all the branches of the circuit shown in the Fig. for Q. No. 6(a). **(11)**

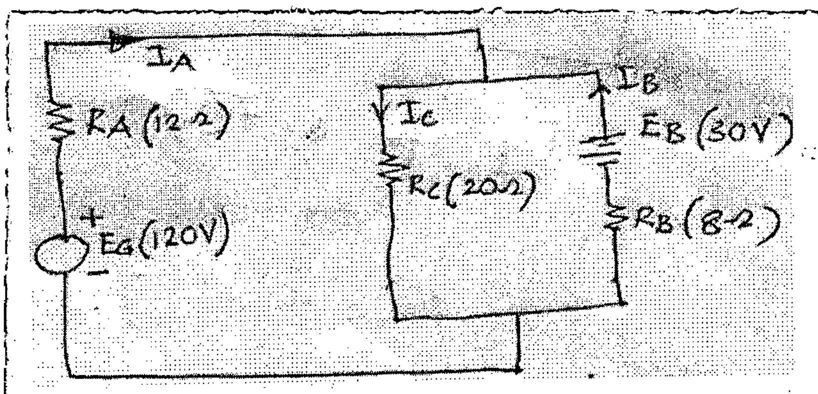


**Fig. for Q. No. 6(a)**

(b) For the network shown in the Fig. for Q. No. 6(b), calculate the loop currents $I_1$, $I_2$ and $I_3$. **(12⅓)**

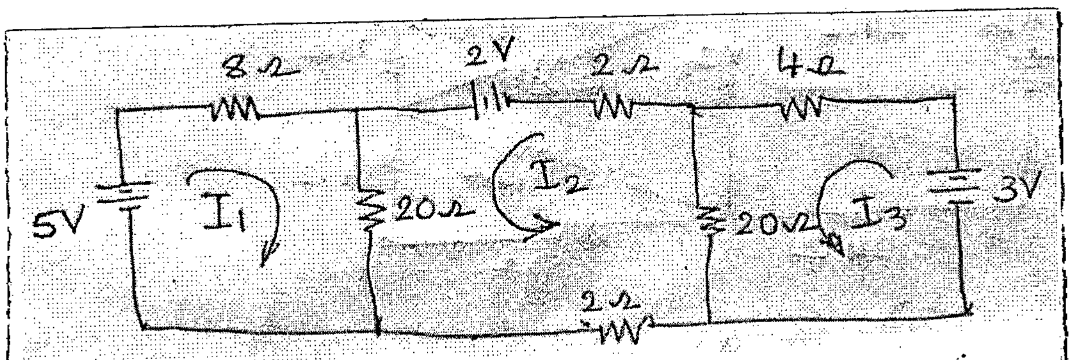


**Fig. for Q. No. 6(b)**

7. (a) A battery which gives 150 A on short circuit will supply a current of 7.5 A to a resistance of 1.5 Ω to its terminals. Determine the EMF and the internal resistance of this battery. **(09)**

(b) Using "Superposition Theorem", find the current in each branch of the following network shown in the Fig. for Q. No. 7(b). **(14⅓)**

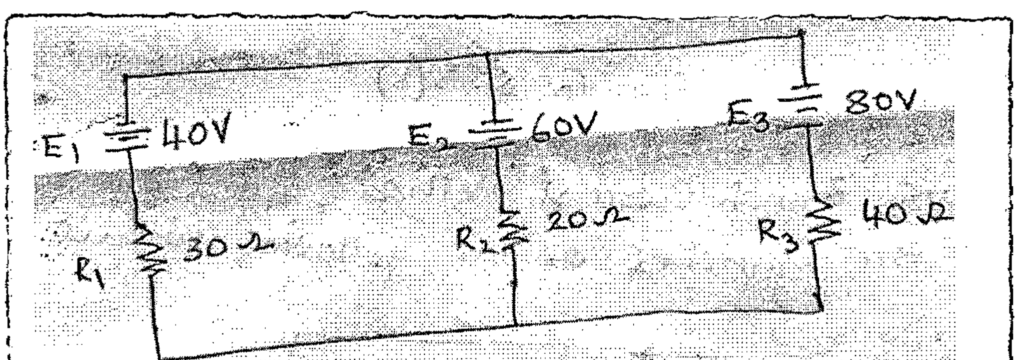


**Fig. for Q. No. 7(b)**

**EEE 373**

8. (a) Using "Thevenin's Theorem", find the current through the branch BD of the network shown in the Fig. for Q. No. 8(a). **(12⅓)**

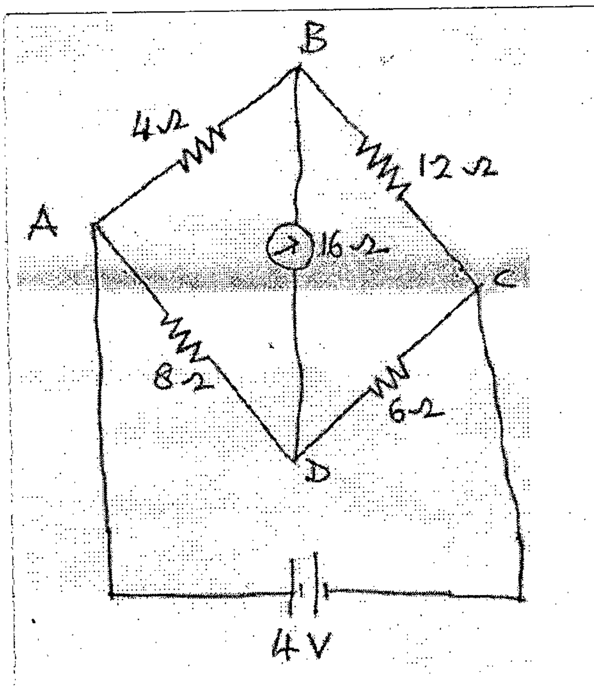


**Fig. for Q. No. 8(a)**

(b) Using "Norton's Theorem", find the current in the branch AB of the network shown in the Fig. for Q. No. 8(b). **(11)**

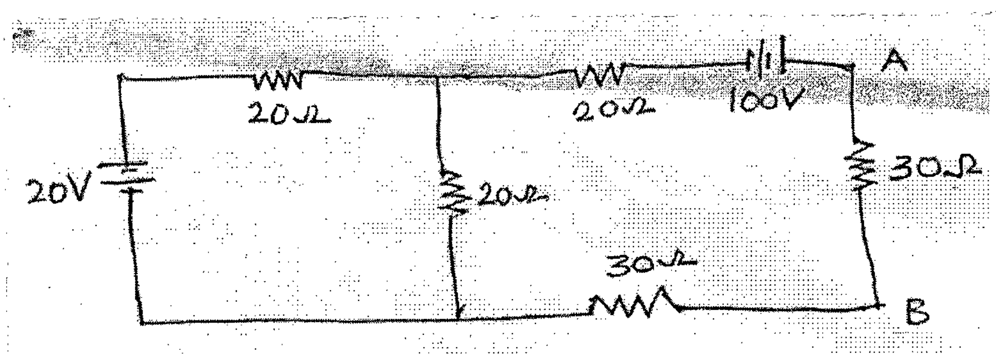


**Fig. for Q. No. 8(b)**

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**L-3/T-2/ARCH** **Date : 27/07/2016**

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-3/T-2 B. Arch. Examinations 2014-2015

Sub : **CE 367** (Structure IV: Steel and Timber Structures)

Full Marks : 140 Time : 3 Hours

The figures in the margin indicate full marks.

Assume reasonable values for missing data, if any.

USE SEPARATE SCRIPTS FOR EACH SECTION

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**SECTION – A**

There are **FOUR** questions in this Section. Answer any **THREE** questions.

1. (a) Select the lightest W12 section of A572 Grade 50 steel for a column of 30 feet long to carry an axial load of 470 kips. Assume the member is hinged at the top and fixed at the bottom for bending about either principal axis. Use AISC/ASD specification. Table for design properties is given in Annexture-1. **(15)**

   (b) Write short notes on **(8⅓)**

   (i) Difference between 'dimension lumber' and 'timber'.

   (ii) Cellular makeup of woods

   (iii) Effective length factor in column

2. (a) Select the lightest W-section from Annexture-1 for a beam supporting a live load of 0.8 kip/ft and a dead load of 0.2 kip/ft. Assume that the beam is fully supported against lateral torsional buckling and has a span of 20 feet. Use A572 Grade 50 steel. **(15)**

   (b) Neatly sketch and explain the bar chart showing different moisture content conditions in lumber. **(8⅓)**

3. (a) Two 2″ × 10″ Spruce Pine Fir is to be used together as a single beam to carry dead load only. The beam is used in wet conditions and normal temperature, and is simply supported at each end and is laterally supported along its length. Total load on the beam is 600 lb/ft and the span of the beam is 10 feet. **(4+6+5)**

   (i) Locate the section where maximum bending stress develops and determine the magnitude of maximum bending stress on the section.

   (ii) Determine the allowable bending stress, $F_b'$ for the beam

   (iii) based on the answers from (i) and (ii), determine if the beam is adequate for supporting the load. If not, determine the number of additional 2″ × 10″ lumbers that are needed to reduce the bending stress below the allowable limit. Use Annexure 2 and 3.

   (b) Briefly explain the factors that need to be considered for the design of wood beams. **(8⅓)**

Contd .......... P/2

## CE 367

4. (a) Compute the axial load carrying capacity of the column section shown in Fig. 1. The column is pin-pin connected about both axes. Length of the column is 20 feet. Assume A36 steel. Use AISC/ASD specifications. **(15)**

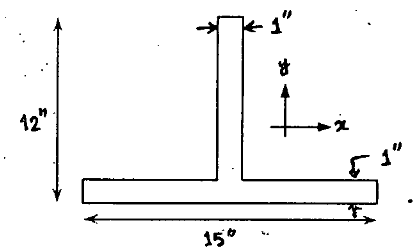

Fig 1: Cross section of column

(b) For the timber beam (two 2″ × 10″ × 10′) mentioned in Q. No. 3(a); **(8 ⅓)**

(i) Locate the section where the maximum value for shear force is observed. Compute the maximum shear stress and check whether it is within the allowable limit.

(ii) Calculate the maximum deflection due to dead load. Also state if this deflection is within the allowable deflection limit for dead load. Assume modulus of elasticity to be `1,400,000 psi. Use Annexure 2 and 3.

## SECTION – B

There are **FOUR** questions in this Section. Answer any **THREE** questions.

5. Following data are given for the question below:

CGI roofing = 2.0 psf

Self-weight of purlins = 1.6 psf

Spacing between adjacent trusses = 30 ft

Design Wind Pressure:

Windward Side = –5 psf

Leeward side = –22 psf

Trial section for Purlin (A36 steel):

(i) C 3 × 4.1 (Sxx = 1.10 $in^3$, Syy = 0.202 $in^3$)

(ii) C 5 × 9 (Sxx = 3.56 $in^3$, Syy = 0.45 $in^3$)

(iii) C 7 × 9.8 (Sxx = 6.08 $in^3$, Syy = 0.625 $in^3$)

Sagrod is provided at half the distance in between trusses.

Consider X-axis in the plane of roofing and Y-axis in the perpendicular direction of the plane of roofing. Equation for moment about X-axis is $wL^2/8$ and moment about Y-axis is $wL^2/32$.

## CE 367

**Contd ... Q. No. 5**

Check the adequacy of the trial purlin sections considering both dead load and wind load for the truss shown in Figure 2. Comment on, whether the sections (1), (2), (3) are adequate or not. Assume $F_y = 36$ ksi and allowable tensile stress = $0.66\ F_y$. **(23⅓)**

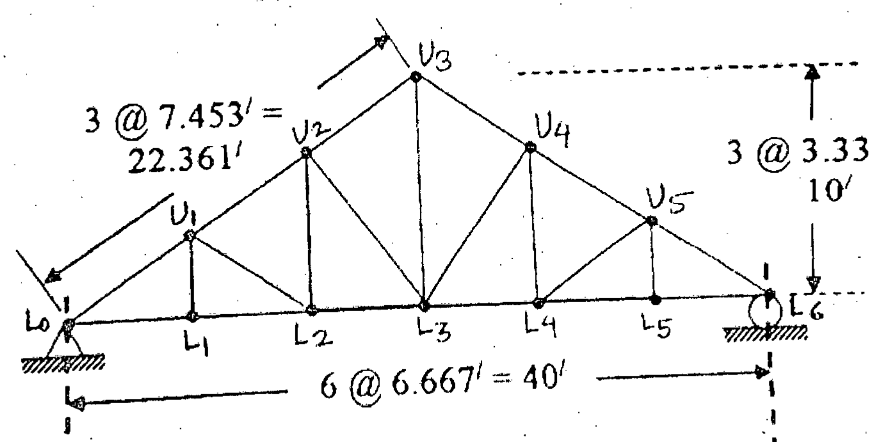


**Figure: 2**

6. Calculate the joint loads for dead load and wind load (show the loading diagram with loads at the joint) for the 40 ft span interior truss of an industrial building (Fig. 2). Spacing between two adjacent trusses (bay) is 25 ft. Show the loads with neat sketches. **(23⅓)**

Given:

Loads:

(a) CGI Sheet Roofing = 2.0 psf

(b) Purlins = 1.5 psf

(c) Sagrod, Bracings = 1 psf

(d) Self-weight of Truss = 60 lb/ft of horizontal span

Design Wind Speed = 210 km/h

Wall Height = 12 ft

$C_c = 47.2 \times 10^{-6}$

$q_z = C_c\, C_I\, C_z\, V_b^2$

$p_z = C_G\, C_{pe}\, q_z$

$1 kN/m^2 = 20.88$ psf

Other charts are enclosed with the question (Annexure 7, 8 and 9).

7. (a) Write down the assumptions of truss analysis. **(5)**

(b) Design the following members of an industrial roof truss (shown in Fig. 2) from the load table given below: **(18⅓)**

Contd .......... P/4

## CE 367

**Contd ... Q. No. 7(b)**

| Member | Member Force (kip) | | |
|---|---|---|---|
| | Dead load (kip) | Wind (left-to-right) (kip) | Wind (right-to-left) (kip) |
| $U_2U_3$ | -10.1 | 14.7 | 20.0 |
| $U_2L_3$ | -11.9 | 2.1 | -30 |
| $U_1L_1$ | 0.5 | 0 | 0 |

Assume, K = 0.6, $F_y$ = 36 ksi, E = 29000 ksi (Annexure 4 is attached for section properties)

8. (a) Draw a simple roof truss and show different components on it. **(5)**

(b) Suppose, members $U_2$ $U_3$ and $U_2$ $L_3$ mentioned in Q. No. 7 (refer to Fig. 2) are designed to be L 2 × 2 × $\frac{5}{16}$ and L 4 × 3 × $\frac{5}{16}$ respectively. At node $U_2$ both of them are connected to a gusset plate of thickness $\frac{7}{16}$ inch. Design fillet welds for this connection. Given, $F_y$ = 36 ksi. Use Annexure 5 and 6. **(18 $\frac{1}{3}$)**

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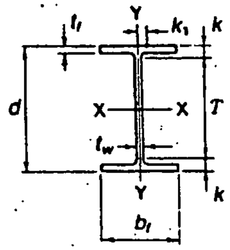
ANNEXURE 1

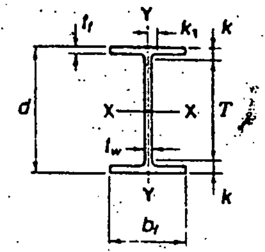



## W SHAPES
### Dimensions

| Designation | Area A | Depth d | | Web Thickness $t_w$ | | $\frac{t_w}{2}$ | Flange Width $b_f$ | | Flange Thickness $t_f$ | | Distance T | Distance k | Distance $k_1$ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | In.² | In. | | In. | | In. | In. | | In. | | In. | In. | In. |
| W 12×336[a] | 98.8 | 16.82 | 16⅞ | 1.775 | 1¾ | ⅞ | 13.385 | 13⅜ | 2.955 | 2$^{15}/_{16}$ | 9½ | 3$^{11}/_{16}$ | 1½ |
| ×305[a] | 89.6 | 16.32 | 16⅜ | 1.625 | 1⅝ | $^{13}/_{16}$ | 13.235 | 13¼ | 2.705 | 2$^{11}/_{16}$ | 9½ | 3$^{7}/_{16}$ | 1$^{7}/_{16}$ |
| ×279[a] | 81.9 | 15.85 | 15⅞ | 1.530 | 1½ | ¾ | 13.140 | 13⅛ | 2.470 | 2½ | 9½ | 3$^{3}/_{16}$ | 1⅜ |
| ×252[a] | 74.1 | 15.41 | 15⅜ | 1.395 | 1⅜ | $^{11}/_{16}$ | 13.005 | 13 | 2.250 | 2¼ | 9½ | 2$^{15}/_{16}$ | 1$^{5}/_{16}$ |
| ×230[a] | 67.7 | 15.05 | 15 | 1.285 | 1$^{5}/_{16}$ | $^{11}/_{16}$ | 12.895 | 12⅞ | 2.070 | 2$^{1}/_{16}$ | 9½ | 2¾ | 1¼ |
| ×210[a] | 61.8 | 14.71 | 14¾ | 1.180 | 1$^{3}/_{16}$ | ⅝ | 12.790 | 12¾ | 1.900 | 1⅞ | 9½ | 2⅝ | 1¼ |
| ×190 | 55.8 | 14.38 | 14⅜ | 1.060 | 1$^{1}/_{16}$ | $^{9}/_{16}$ | 12.670 | 12⅝ | 1.735 | 1¾ | 9½ | 2$^{7}/_{16}$ | 1$^{3}/_{16}$ |
| ×170 | 50.0 | 14.03 | 14 | 0.960 | $^{15}/_{16}$ | ½ | 12.570 | 12⅝ | 1.560 | 1$^{9}/_{16}$ | 9½ | 2¼ | 1⅛ |
| ×152 | 44.7 | 13.71 | 13¾ | 0.870 | ⅞ | $^{7}/_{16}$ | 12.480 | 12½ | 1.400 | 1⅜ | 9½ | 2⅛ | 1$^{1}/_{16}$ |
| ×136 | 39.9 | 13.41 | 13⅜ | 0.790 | $^{13}/_{16}$ | $^{7}/_{16}$ | 12.400 | 12⅜ | 1.250 | 1¼ | 9½ | 1$^{15}/_{16}$ | 1 |
| ×120 | 35.3 | 13.12 | 13⅛ | 0.710 | $^{11}/_{16}$ | ⅜ | 12.320 | 12⅜ | 1.105 | 1⅛ | 9½ | 1$^{13}/_{16}$ | 1 |
| ×106 | 31.2 | 12.89 | 12⅞ | 0.610 | ⅝ | $^{5}/_{16}$ | 12.220 | 12¼ | 0.990 | 1 | 9½ | 1$^{11}/_{16}$ | $^{15}/_{16}$ |
| × 96 | 28.2 | 12.71 | 12¾ | 0.550 | $^{9}/_{16}$ | $^{5}/_{16}$ | 12.160 | 12⅛ | 0.900 | ⅞ | 9½ | 1⅝ | ⅞ |
| × 87 | 25.6 | 12.53 | 12½ | 0.515 | ½ | ¼ | 12.125 | 12⅛ | 0.810 | $^{13}/_{16}$ | 9½ | 1½ | ⅞ |
| × 79 | 23.2 | 12.38 | 12⅜ | 0.470 | ½ | ¼ | 12.080 | 12⅛ | 0.735 | ¾ | 9½ | 1$^{7}/_{16}$ | ⅞ |
| × 72 | 21.1 | 12.25 | 12¼ | 0.430 | $^{7}/_{16}$ | ¼ | 12.040 | 12 | 0.670 | $^{11}/_{16}$ | 9½ | 1⅜ | ⅞ |
| × 65 | 19.1 | 12.12 | 12⅛ | 0.390 | ⅜ | $^{3}/_{16}$ | 12.000 | 12 | 0.605 | ⅝ | 9½ | 1$^{5}/_{16}$ | $^{13}/_{16}$ |
| W 12× 58 | 17.0 | 12.19 | 12¼ | 0.360 | ⅜ | $^{3}/_{16}$ | 10.010 | 10 | 0.640 | ⅝ | 9½ | 1⅜ | $^{13}/_{16}$ |
| × 53 | 15.6 | 12.06 | 12 | 0.345 | ⅜ | $^{3}/_{16}$ | 9.995 | 10 | 0.575 | $^{9}/_{16}$ | 9½ | 1¼ | $^{13}/_{16}$ |
| W 12× 50 | 14.7 | 12.19 | 12¼ | 0.370 | ⅜ | $^{3}/_{16}$ | 8.080 | 8⅛ | 0.640 | ⅝ | 9½ | 1⅜ | $^{13}/_{16}$ |
| × 45 | 13.2 | 12.06 | 12 | 0.335 | $^{5}/_{16}$ | $^{3}/_{16}$ | 8.045 | 8 | 0.575 | $^{9}/_{16}$ | 9½ | 1¼ | $^{13}/_{16}$ |
| × 40 | 11.8 | 11.94 | 12 | 0.295 | $^{5}/_{16}$ | $^{3}/_{16}$ | 8.005 | 8 | 0.515 | ½ | 9½ | 1¼ | ¾ |
| W 12× 35 | 10.3 | 12.50 | 12½ | 0.300 | $^{5}/_{16}$ | $^{3}/_{16}$ | 6.560 | 6½ | 0.520 | ½ | 10½ | 1 | $^{9}/_{16}$ |
| × 30 | 8.79 | 12.34 | 12⅜ | 0.260 | ¼ | ⅛ | 6.520 | 6½ | 0.440 | $^{7}/_{16}$ | 10½ | $^{15}/_{16}$ | ½ |
| × 26 | 7.65 | 12.22 | 12¼ | 0.230 | ¼ | ⅛ | 6.490 | 6½ | 0.380 | ⅜ | 10½ | ⅞ | ½ |
| W 12× 22 | 6.48 | 12.31 | 12¼ | 0.260 | ¼ | ⅛ | 4.030 | 4 | 0.425 | $^{7}/_{16}$ | 10½ | ⅞ | ½ |
| × 19 | 5.57 | 12.16 | 12⅛ | 0.235 | ¼ | ⅛ | 4.005 | 4 | 0.350 | ⅜ | 10½ | $^{13}/_{16}$ | ½ |
| × 16 | 4.71 | 11.99 | 12 | 0.220 | ¼ | ⅛ | 3.990 | 4 | 0.265 | ¼ | 10½ | ¾ | ½ |
| × 14 | 4.16 | 11.91 | 11⅞ | 0.200 | $^{3}/_{16}$ | ⅛ | 3.970 | 4 | 0.225 | ¼ | 10½ | $^{11}/_{16}$ | ½ |

[a]For application refer to Notes in Table 2.
Shapes in shaded rows are not available from domestic producers.

## W SHAPES
### Properties




| Nominal Wt. per Ft. | Compact Section Criteria $\frac{b_f}{2t_f}$ | $F_y'$ | $\frac{d}{t_w}$ | $F_y'''$ | $r_T$ | $\frac{d}{A_f}$ | Axis X-X I | Axis X-X S | Axis X-X r | Axis Y-Y I | Axis Y-Y S | Axis Y-Y r | Plastic Modulus $Z_x$ | Plastic Modulus $Z_y$ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lb. | | Ksi | | Ksi | In. | | In.⁴ | In.³ | In. | In.⁴ | In.³ | In. | In.³ | In.³ |
| 336 | 2.3 | — | 9.5 | — | 3.71 | 0.43 | 4060 | 483 | 6.41 | 1190 | 177 | 3.47 | 603 | 274 |
| 305 | 2.4 | — | 10.0 | — | 3.67 | 0.46 | 3550 | 435 | 6.29 | 1050 | 159 | 3.42 | 537 | 244 |
| 279 | 2.7 | — | 10.3 | — | 3.64 | 0.49 | 3110 | 393 | 6.16 | 937 | 143 | 3.38 | 481 | 220 |
| 252 | 2.9 | — | 11.0 | — | 3.59 | 0.53 | 2720 | 353 | 6.06 | 828 | 127 | 3.34 | 428 | 196 |
| 230 | 3.1 | — | 11.7 | — | 3.56 | 0.56 | 2420 | 321 | 5.97 | 742 | 115 | 3.31 | 386 | 177 |
| 210 | 3.4 | — | 12.5 | — | 3.53 | 0.61 | 2140 | 292 | 5.89 | 664 | 104 | 3.28 | 348 | 159 |
| 190 | 3.7 | — | 13.6 | — | 3.50 | 0.65 | 1890 | 263 | 5.82 | 589 | 93.0 | 3.25 | 311 | 143 |
| 170 | 4.0 | — | 14.6 | — | 3.47 | 0.72 | 1650 | 235 | 5.74 | 517 | 82.3 | 3.22 | 275 | 126 |
| 152 | 4.5 | — | 15.8 | — | 3.44 | 0.79 | 1430 | 209 | 5.66 | 454 | 72.8 | 3.19 | 243 | 111 |
| 136 | 5.0 | — | 17.0 | — | 3.41 | 0.87 | 1240 | 186 | 5.58 | 398 | 64.2 | 3.16 | 214 | 98.0 |
| 120 | 5.6 | — | 18.5 | — | 3.38 | 0.96 | 1070 | 163 | 5.51 | 345 | 56.0 | 3.13 | 186 | 85.4 |
| 106 | 6.2 | — | 21.1 | — | 3.36 | 1.07 | 933 | 145 | 5.47 | 301 | 49.3 | 3.11 | 164 | 75.1 |
| 96 | 6.8 | — | 23.1 | — | 3.34 | 1.16 | 833 | 131 | 5.44 | 270 | 44.4 | 3.09 | 147 | 67.5 |
| 87 | 7.5 | — | 24.3 | — | 3.32 | 1.28 | 740 | 118 | 5.38 | 241 | 39.7 | 3.07 | 132 | 60.4 |
| 79 | 8.2 | 62.6 | 26.3 | — | 3.31 | 1.39 | 662 | 107 | 5.34 | 216 | 35.8 | 3.05 | 119 | 54.3 |
| 72 | 9.0 | 52.3 | 28.5 | — | 3.29 | 1.52 | 597 | 97.4 | 5.31 | 195 | 32.4 | 3.04 | 108 | 49.2 |
| 65 | 9.9 | 43.0 | 31.1 | — | 3.28 | 1.67 | 533 | 87.9 | 5.28 | 174 | 29.1 | 3.02 | 96.8 | 44.1 |
| 58 | 7.8 | — | 33.9 | 57.6 | 2.72 | 1.90 | 475 | 78.0 | 5.28 | 107 | 21.4 | 2.51 | 86.4 | 32.5 |
| 53 | 8.7 | 55.9 | 35.0 | 54.1 | 2.71 | 2.10 | 425 | 70.6 | 5.23 | 95.8 | 19.2 | 2.48 | 77.9 | 29.1 |
| 50 | 6.3 | — | 32.9 | 60.9 | 2.17 | 2.36 | 394 | 64.7 | 5.18 | 56.3 | 13.9 | 1.96 | 72.4 | 21.4 |
| 45 | 7.0 | — | 36.0 | 51.0 | 2.15 | 2.61 | 350 | 58.1 | 5.15 | 50.0 | 12.4 | 1.94 | 64.7 | 19.0 |
| 40 | 7.8 | — | 40.5 | 40.3 | 2.14 | 2.90 | 310 | 51.9 | 5.13 | 44.1 | 11.0 | 1.93 | 57.5 | 16.8 |
| 35 | 6.3 | — | 41.7 | 38.0 | 1.74 | 3.66 | 285 | 45.6 | 5.25 | 24.5 | 7.47 | 1.54 | 51.2 | 11.5 |
| 30 | 7.4 | — | 47.5 | 29.3 | 1.73 | 4.30 | 238 | 38.6 | 5.21 | 20.3 | 6.24 | 1.52 | 43.1 | 9.56 |
| 26 | 8.5 | 57.9 | 53.1 | 23.4 | 1.72 | 4.95 | 204 | 33.4 | 5.17 | 17.3 | 5.34 | 1.51 | 37.2 | 8.17 |
| 22 | 4.7 | — | 47.3 | 29.5 | 1.02 | 7.19 | 156 | 25.4 | 4.91 | 4.66 | 2.31 | 0.847 | 29.3 | 3.66 |
| 19 | 5.7 | — | 51.7 | 24.7 | 1.00 | 8.67 | 130 | 21.3 | 4.82 | 3.76 | 1.88 | 0.822 | 24.7 | 2.98 |
| 16 | 7.5 | — | 54.5 | 22.2 | 0.96 | 11.8 | 103 | 17.1 | 4.67 | 2.82 | 1.41 | 0.773 | 20.1 | 2.26 |
| 14 | 8.8 | 54.3 | 59.6 | 18.6 | 0.95 | 13.3 | 88.6 | 14.9 | 4.62 | 2.36 | 1.19 | 0.753 | 17.4 | 1.90 |

# ANNEXURE 2

| Moisture Content Factors $C_M$ [a,b,e] | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Strength Property | Fb | Ft | Fc | Fc⊥ | Fv | E | Frt | Fg |
| Sawn Lumber, Visual or Machine Graded<br>Wet conditions of use MC > 19%<br>Dimension lumber (including Southern Pine) | 0.85[a] | 1.00 | 0.80[b] | 0.67 | 0.97 | 0.90 | -- | --d |
| 5 in. X 5 in. and larger | 1.00 | 1.00 | 0.91 | 0.67 | 1.00 | 1.00 | -- | --d |
| Decking<br>Wet conditions if use all<br>Species except Southern Pine[c] | 0.85 | -- | -- | 0.67 | -- | 0.90 | -- | -- |

Notes:
a) When $(F_b)(C_F)$ for dimension lumber of all species ≤ 1150 psi, $C_M$ = 1.0.
b) When $(F_c)(C_F)$ for dimension lumber of all species except Southern Pine ≤ 750 psi, $C_M$ = 1.0; when $F_c$ for visually graded Southern Pine ≤ 750 psi, $C_M$ = 1.0.
c) For Southern Pine, use Reference design values for wet service conditions

| SIZE FACTORS, $C_F$- for Sawn Lumber not including Southern Pine | | | | | |
|---|---|---|---|---|---|
| | | $F_b$ | | $F_t$ | $F_c$ |
| Grades | Width/Depth | Thickness | | | |
| | | 2" & 3" | 4" | | |
| Select Structural, No.1 & Btr. No. 1, No. 2, No. 3 | 2",3"&4" | 1.5 | 1.5 | 1.5 | 1.15 |
| | 5" | 1.4 | 1.4 | 1.4 | 1.1 |
| | 6" | 1.3 | 1.3 | 1.3 | 1.1 |
| | 8" | 1.2 | 1.3 | 1.2 | 1.05 |
| | 10" | 1.1 | 1.2 | 1.1 | 1.0 |
| | 12" | 1.0 | 1.1 | 1.0 | 1.0 |
| | 14" & Wider | 0.9 | 1.0 | 0.9 | 0.9 |
| Stud | 2", 3" & 4" | 1.1 | 1.1 | 1.1 | 1.05 |
| | 5" & 6" | 1.0 | 1.0 | 1.0 | 1.0 |
| Construction & Standard | 2", 3, & 4" | 1.0 | 1.0 | 1.0 | 1.0 |
| Utility | 4" | 1.0 | 1.0 | 1.0 | 1.0 |
| | 2" & 3" | 0.4 | -- | 0.4 | 0.6 |

| Frequently Used Load Durations Factors $C_D$[1] | | |
|---|---|---|
| Load Duration | $C_D$ | Typical Design Loads |
| Permanent (>10 yrs) | 0.9 | Dead Load |
| Ten Years (Normal) | 1.0 | Occupancy Live Load |
| Two Months | 1.15 | Snow Load |
| Seven Days | 1.25 | Construction Load (Roof Included) |
| Ten Minutes | 1.6 | Wind/Earthquake Load |
| Impact[2] | 2.0 | Impact Load |

## ANNEXURE 3

| TEMPERATURE FACTORS, $C_t$ | | | | |
|---|---|---|---|---|
| Design Values | In Service Moisture Conditions | $C_t$ T≤100°F | $C_t$ 100°F<T≤125°F | $C_t$ 125°F<T≤150°F |
| $F_t$, E | Wet or Dry | 1.0 | 0.9 | 0.9 |
| $F_b$, $F_v$, $F_c$ and $F_{c\perp}$ | Dry | 1.0 | 0.8 | 0.7 |
| $F_b$, $F_v$, $F_c$ and $F_{c\perp}$ | Wet | 1.0 | 0.7 | 0.5 |

**Design Values for Visually Graded Dimension Lumber (2"-4" thick) Except Southern Pine* ****

| Species and commercial grade | Size classification | Bending Fb | Tension parallel to grain Ft | Shear parallel to grain Fv | Compression perpendicular to grain Fc1 | Compression parallel to grain Fc | Modulus of Elasticity E | Minimum Modulus of Elasticity Emin |
|---|---|---|---|---|---|---|---|---|
| **Redwood** | | | | | | | | |
| Clear Structural | | 1750 | 1000 | 160 | 650 | 1850 | 1400000 | 510000 |
| Select Structural | | 1350 | 800 | 160 | 650 | 1500 | 1400000 | 510000 |
| Select Structural, open grain | | 1100 | 625 | 160 | 425 | 1100 | 1100000 | 400000 |
| No. 1 | | 975 | 575 | 160 | 650 | 1200 | 1300000 | 470000 |
| No.1, open grain | | 775 | 450 | 160 | 425 | 900 | 1100000 | 400000 |
| No. 2 | 2" & wider | 925 | 525 | 160 | 650 | 950 | 1200000 | 440000 |
| No.2, open grain | | 725 | 425 | 160 | 425 | 700 | 1000000 | 370000 |
| No. 3 | | 525 | 300 | 160 | 650 | 550 | 1100000 | 400000 |
| No.3, open grain | | 425 | 250 | 160 | 425 | 400 | 900000 | 330000 |
| Stud | | 575 | 325 | 160 | 425 | 450 | 900000 | 330000 |
| Construction | 2" & wider | 825 | 475 | 160 | 425 | 925 | 900000 | 330000 |
| Standard | | 450 | 275 | 160 | 425 | 725 | 900000 | 330000 |
| Utility | 2"- 4" wide | 225 | 125 | 160 | 425 | 475 | 800000 | 290000 |
| **Spruce-Pine-Fir** | | | | | | | | |
| Select Structural | | 1250 | 700 | 135 | 425 | 1400 | 1500000 | 550000 |
| No. 1/No. 2 | 2" & wider | 875 | 450 | 135 | 425 | 1150 | 1400000 | 510000 |
| No. 3 | | 500 | 250 | 135 | 425 | 650 | 1200000 | 440000 |
| Stud | 2" & wider | 675 | 350 | 135 | 425 | 725 | 1200000 | 440000 |
| Construction | | 1000 | 500 | 135 | 425 | 1400 | 1300000 | 470000 |
| Standard | 2"- 4" wide | 550 | 275 | 135 | 425 | 1150 | 1200000 | 440000 |
| Utility | | 275 | 125 | 135 | 425 | 750 | 1100000 | 400000 |

Recommended Deflection Limitations

| Use classification | Applied load only | Applied load + dead load |
|---|---|---|
| Roof beams | | |
| Industrial | $l/180$ | $l/120$ |
| Commercial and institutional | | |
| Without plaster ceiling | $l/240$ | $l/180$ |
| With plaster ceiling | $l/360$ | $l/240$ |
| Floor beams | | |
| Ordinary usage* | $l/360$ | $l/240$ |
| Highway bridge stringers | $l/200$ to $l/300$ | |
| Railway bridge stringers | $l/300$ to $l/400$ | |

* The ordinary usage classification is for floors intended for construction in which walking comfort and minimized plaster cracking are the main considerations. These recommended deflection limits may not eliminate all objections to vibrations such as in long spans approaching the maximum limits or for some office and institutional applications where increased floor stiffness is desired. For these usages the deflection limitations in the following table have been found to provide additional stiffness.

## Annexure-14

| Section | Area (in^2) | Ix (in^4) | Sx (in^3) | rx (in) | Iy (in^4) | Sy (in^3) | ry (in) | Iz (in^4) | rz (in) |
|---|---|---|---|---|---|---|---|---|---|
| L4X4X3/8 | 2.86 | 4.32 | 1.8 | 1.23 | 4.32 | 1.5 | 1.23 | 1.73 | 0.779 |
| L4X4X7/16 | 3.3 | 4.93 | 1.73 | 1.22 | 4.93 | 1.73 | 1.22 | 1.99 | 0.777 |
| L4X4X1/2 | 3.75 | 5.52 | 1.96 | 1.21 | 5.52 | 1.96 | 1.21 | 2.25 | 0.776 |
| L4X4X3/4 | 5.44 | 7.62 | 2.79 | 1.18 | 7.62 | 2.79 | 1.18 | 3.25 | 0.774 |
| L4X4X5/8 | 4.61 | 6.62 | 2.38 | 1.2 | 6.62 | 2.38 | 1.2 | 2.78 | 0.774 |
| L4X3-1/2X3/8 | 2.58 | 4.15 | 1.48 | 1.25 | 2.96 | 1.16 | 1.05 | 1.39 | 0.719 |
| L4X3-1/2X1/2 | 3.5 | 5.3 | 1.92 | 1.23 | 3.76 | 1.5 | 1.04 | 1.79 | 0.716 |
| L3-1/2X3-1/2X1/4 | 1.7 | 2 | 0.787 | 1.09 | 2 | 0.787 | 1.09 | 0.802 | 0.688 |
| L3-1/2X3-1/2X5/16 | 2.1 | 2.44 | 0.969 | 1.08 | 2.44 | 0.969 | 1.08 | 0.984 | 0.685 |
| L3-1/2X3-1/2X3/8 | 2.5 | 2.86 | 1.15 | 1.07 | 2.86 | 1.15 | 1.07 | 1.17 | 0.683 |
| L3-1/2X3X1/4 | 1.68 | 1.92 | 0.773 | 1.1 | 1.3 | 0.585 | 0.908 | 0.622 | 0.628 |
| L3-1/2X3X5/16 | 1.95 | 2.33 | 0.951 | 1.09 | 1.58 | 0.718 | 0.9 | 0.756 | 0.624 |
| L3-1/2X3X3/8 | 2.32 | 2.73 | 1.12 | 1.09 | 1.84 | 0.847 | 0.892 | 0.894 | 0.622 |
| L3-1/2X3X7/16 | 2.87 | 3.1 | 1.29 | 1.08 | 2.09 | 0.971 | 0.885 | 1.02 | 0.62 |
| L3X3X1/4 | 1.44 | 1.23 | 0.589 | 0.926 | 1.23 | 0.569 | 0.926 | 0.49 | 0.586 |
| L3X3X5/16 | 1.78 | 1.5 | 0.699 | 0.918 | 1.5 | 0.699 | 0.918 | 0.606 | 0.583 |
| L3X3X3/8 | 2.11 | 1.75 | 0.825 | 0.91 | 1.75 | 0.825 | 0.91 | 0.716 | 0.581 |
| L3X3X7/16 | 2.43 | 1.98 | 0.946 | 0.903 | 1.98 | 0.946 | 0.903 | 0.817 | 0.58 |
| L3-1/2X2-1/2X1/4 | 1.45 | 1.81 | 0.753 | 1.12 | 0.776 | 0.41 | 0.731 | 0.426 | 0.541 |
| L3-1/2X2-1/2X5/16 | 1.79 | 2.2 | 0.925 | 1.11 | 0.937 | 0.501 | 0.723 | 0.518 | 0.538 |
| L3-1/2X2-1/2X3/8 | 2.12 | 2.56 | 1.09 | 1.1 | 1.09 | 0.589 | 0.716 | 0.609 | 0.535 |
| L3X2-1/2X5/16 | 1.63 | 1.41 | 0.681 | 0.932 | 0.888 | 0.487 | 0.739 | 0.436 | 0.518 |
| L3X2-1/2X3/8 | 1.93 | 1.65 | 0.803 | 0.924 | 1.03 | 0.573 | 0.731 | 0.514 | 0.517 |
| L3X2-1/2X1/2 | 2.6 | 2.07 | 1.03 | 0.91 | 1.29 | 0.736 | 0.716 | 0.665 | 0.516 |
| L3X2-1/2X7/16 | 2.22 | 1.87 | 0.921 | 0.917 | 1.17 | 0.656 | 0.724 | 0.594 | 0.518 |
| L2-1/2X2-1/2X1/4 | 1.19 | 0.692 | 0.387 | 0.764 | 0.692 | 0.387 | 0.764 | 0.276 | 0.482 |
| L2-1/2X2-1/2X3/16 | 0.901 | 0.535 | 0.295 | 0.771 | 0.535 | 0.295 | 0.771 | 0.209 | 0.482 |
| L2-1/2X2X3/16 | 0.818 | 0.511 | 0.293 | 0.79 | 0.292 | 0.195 | 0.597 | 0.146 | 0.428 |
| L2-1/2X2X1/4 | 1.07 | 0.656 | 0.381 | 0.782 | 0.372 | 0.253 | 0.589 | 0.192 | 0.423 |
| L2-1/2X2X5/16 | 1.32 | 0.79 | 0.465 | 0.774 | 0.446 | 0.309 | 0.581 | 0.233 | 0.42 |
| L2X2X1/8 | 0.491 | 0.189 | 0.129 | 0.62 | 0.189 | 0.129 | 0.62 | 0.0756 | 0.391 |
| L2X2X3/16 | 0.722 | 0.271 | 0.186 | 0.612 | 0.271 | 0.188 | 0.612 | 0.109 | 0.389 |
| L2X2X1/4 | 0.944 | 0.346 | 0.244 | 0.605 | 0.346 | 0.244 | 0.605 | 0.142 | 0.387 |
| L2X2X3/8 | 1.37 | 0.476 | 0.348 | 0.591 | 0.476 | 0.348 | 0.591 | 0.203 | 0.386 |
| L2X2X5/16 | 1.16 | 0.414 | 0.298 | 0.598 | 0.414 | 0.298 | 0.598 | 0.172 | 0.388 |
| L2-1/2X1-1/2X3/16 | 0.724 | 0.464 | 0.28 | 0.801 | 0.126 | 0.11 | 0.418 | 0.0754 | 0.324 |
| L2-1/2X1-1/2X1/4 | 0.947 | 0.594 | 0.384 | 0.792 | 0.16 | 0.142 | 0.411 | 0.0977 | 0.321 |

Annexure ~~2~~ 5: Minimum size of fillet weld

| Minimum Fillet Weld Size (inch) | Maximum thickness of part (inch) |
|---|---|
| 1/8 | To ¼ inclusive |
| 3/16 | Over ¼ to ½ |
| ¼ | Over 1/2 to 3/4 |
| 5/16 | Over 3/4 to 1 ½ |
| 3/8 | Over 1 ½ to 2 ¼ |
| 1/2 | Over 2 ¼ to 6 |
| 5/8 | Over 6 |

Annexure ~~3~~ 6 Maximum size of fillet weld

| Maximum fillet weld size (inch | Minimum thickness of part (inch) |
|---|---|
| Thickness of material | Less than ¼ inch |
| Thickness of material – 1/16 inch | ¼ inch & over ¼ inch |

Annexure ~~4~~ 7

**External Pressure Coefficients, $C_{pe}$ for Roof †**

| Wind Direction | $h/L$ | Windward Side: $\theta$ (degrees) 0 | 10-15 | 20 | 30 | 40 | 50 | > 60 | Leeward Side |
|---|---|---|---|---|---|---|---|---|---|
| Normal to ridge | ≤ 0.3 | - 0.7 | 0.2*<br>- 0.9* | 0.2 | 0.3 | 0.4 | 0.5 | 0.01 $\theta$ | - 0.7 for all values of $h/L$ and $\theta$ |
| | 0.5 | - 0.7 | - 0.9 | - 0.75 | - 0.2 | 0.3 | 0.5 | 0.01 $\theta$ | |
| | 1.0 | - 0.7 | - 0.9 | - 0.75 | - 0.2 | 0.3 | 0.5 | 0.01 $\theta$ | |
| | ≥ 1.5 | - 0.7 | - 0.9 | - 0.9 | - 0.9 | - 0.35 | 0.2 | 0.01 $\theta$ | |
| Parallel to ridge | $h/B$ or $h/L$ ≤ 2.5 | | | | - 0.7 | | | | - 0.7 |
| | $h/B$ or $h/L$ > 2.5 | | | | - 0.8 | | | | - 0.8 |

† Coefficients are to be used with $p_h = C_G C_{pe} q_h$, see Sec 2.4.6.6(a)

* Both values of $C_{pe}$ shall be used for load calculations.

Annexure 8

Combined Height and Exposure Coefficient, $C_z$

| Height above ground level, z (metres) | Coefficient, $C_z$ (1) | | |
|---|---|---|---|
| | Exposure A | Exposure B | Exposure C |
| 0-4.5 | 0.368 | 0.801 | 1.196 |
| 6.0 | 0.415 | 0.866 | 1.263 |
| 9.0 | 0.497 | 0.972 | 1.370 |
| 12.0 | 0.565 | 1.055 | 1.451 |
| 15.0 | 0.624 | 1.125 | 1.517 |
| 18.0 | 0.677 | 1.185 | 1.573 |
| 21.0 | 0.725 | 1.238 | 1.623 |
| 24.0 | 0.769 | 1.286 | 1.667 |
| 27.0 | 0.810 | 1.330 | 1.706 |
| 30.0 | 0.849 | 1.371 | 1.743 |
| 35.0 | 0.909 | 1.433 | 1.797 |
| 40.0 | 0.965 | 1.488 | 1.846 |
| 45.0 | 1.017 | 1.539 | 1.890 |
| 50.0 | 1.065 | 1.586 | 1.930 |
| 60.0 | 1.155 | 1.671 | 2.002 |
| 70.0 | 1.237 | 1.746 | 2.065 |
| 80.0 | 1.313 | 1.814 | 2.120 |
| 90.0 | 1.383 | 1.876 | 2.171 |
| 100.0 | 1.450 | 1.934 | 2.217 |
| 110.0 | 1.513 | 1.987 | 2.260 |
| 120.0 | 1.572 | 2.037 | 2.299 |
| 130.0 | 1.629 | 2.084 | 2.337 |
| 140.0 | 1.684 | 2.129 | 2.371 |
| 150.0 | 1.736 | 2.171 | 2.404 |
| 160.0 | 1.787 | 2.212 | 2.436 |
| 170.0 | 1.835 | 2.250 | 2.465 |
| 180.0 | 1.883 | 2.287 | 2.494 |
| 190.0 | 1.928 | 2.323 | 2.521 |
| 200.0 | 1.973 | 2.357 | 2.547 |
| 220.0 | 2.058 | 2.422 | 2.596 |
| 240.0 | 2.139 | 2.483 | 2.641 |
| 260.0 | 2.217 | 2.541 | 2.684 |
| 280.0 | 2.910 | 2.595 | 2.724 |
| 300.0 | 2.362 | 2.647 | 2.762 |

Note : (1) Linear interpolation is acceptable for intermediate values of z.

Annexure 9

Gust Response Factors, $G_h$ and $G_z$[1]

| Height above ground level (metres) | $G_h$ [2] and $G_z$ | | |
|---|---|---|---|
| | Exposure A | Exposure B | Exposure C |
| 0-4.5 | 1.654 | 1.321 | 1.154 |
| 6.0 | 1.592 | 1.294 | 1.140 |
| 9.0 | 1.511 | 1.258 | 1.121 |
| 12.0 | 1.457 | 1.233 | 1.107 |
| 15.0 | 1.418 | 1.215 | 1.097 |
| 18.0 | 1.388 | 1.201 | 1.089 |
| 21.0 | 1.363 | 1.189 | 1.082 |
| 24.0 | 1.342 | 1.178 | 1.077 |
| 27.0 | 1.324 | 1.170 | 1.072 |
| 30.0 | 1.309 | 1.162 | 1.067 |
| 35.0 | 1.287 | 1.151 | 1.061 |
| 40.0 | 1.268 | 1.141 | 1.055 |
| 45.0 | 1.252 | 1.133 | 1.051 |
| 50.0 | 1.238 | 1.126 | 1.046 |
| 60.0 | 1.215 | 1.114 | 1.039 |
| 70.0 | 1.196 | 1.103 | 1.033 |
| 80.0 | 1.180 | 1.095 | 1.028 |
| 90.0 | 1.166 | 1.087 | 1.024 |
| 100.0 | 1.154 | 1.081 | 1.020 |
| 110.0 | 1.114 | 1.075 | 1.016 |
| 120.0 | 1.134 | 1.070 | 1.013 |
| 130.0 | 1.126 | 1.065 | 1.010 |
| 140.0 | 1.118 | 1.061 | 1.008 |
| 150.0 | 1.111 | 1.057 | 1.005 |
| 160.0 | 1.104 | 1.053 | 1.003 |
| 170.0 | 1.098 | 1.049 | 1.001 |
| 180.0 | 1.092 | 1.046 | 1.000 |
| 190.0 | 1.087 | 1.043 | 1.000 |
| 200.0 | 1.082 | 1.040 | 1.000 |
| 220.0 | 1.073 | 1.035 | 1.000 |
| 240.0 | 1.065 | 1.030 | 1.000 |
| 260.0 | 1.058 | 1.026 | 1.000 |
| 280.0 | 1.051 | 1.022 | 1.000 |
| 300.0 | 1.045 | 1.018 | 1.000 |

Note: (1) For main wind-force resisting systems, use building or structure height $h$ for $z$.

(2) Linear interpolation is acceptable for intermediate values of $z$.

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-3/T-2 B. Sc. Engineering Examinations 2014-2015

Sub : **ARCH 397** (Interior Design)

Full Marks: 140 Time : 3 Hours

USE SEPARATE SCRIPTS FOR EACH SECTION

The figures in the margin indicate full marks.

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## SECTION – A

There are **FOUR** questions in this section. Answer **Q. No. 1** and any **TWO** from the rest.

1. What are the ways a space can be modified by interior design? Explain with diagrams. **(20)**

2. Discuss three different types of structural system; Linear Structural system, planar structural system and volumetric structural system. **(25)**

3. (a) Explain the process of interior design. **(25)**
   (b) Explain different plan arrangements with keywords "Tight fit" and "Loose fit".

4. "Space is a prime ingredient in the designers pallette and an essential element in interior design"— Explain. **(25)**

## SECTION – B

There are **FOUR** questions in this section. Answer **Q. No. 5** and any **TWO** from the rest.

5. What are the factors to be considered before selecting internal finish material. Describe with example at least three types of floor finishes. **(20)**

6. Describe with neat sketches the types of walls and partitions considered in interior spaces. **(25)**

7. Draw and explain different types and forms of ceilings used in interior spaces. **(25)**

8. Name and draw different types of doors and windows according to its operation and construction. **(25)**

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