L-2/T-2/ARCH **Date : 20/07/2016**

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

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

Sub : **ARCH 253** (Design Theory II)

Full Marks : 140 Time : 3 Hours

The figures in the margin indicate full marks.

USE SEPARATE SCRIPTS FOR EACH SECTION

SECTION – A

There are **FOUR** questions in this section. Answer **Q. No. 4** and any **TWO** from the rest.

1. Describe 'plane' as primary element in architecture. **(20)**

2. How 'L-shaped plane' and 'Parallel plane' define spaces. Explain them with sketches. **(20)**

3. Discuss the different types of Additive forms generated due to additive transformation. **(20)**

4. Write short notes on the following: **(15×2=30)**

   (a) Platonic solids

   (b) Articulation of form

SECTION – B

There are **FOUR** questions in this section. Answer **Q. No. 8** and any **TWO** from the rest.

5. Write notes on the following: **(2×10=20)**

   (a) Modular

   (b) Scale

6. Explain how Clustered and Grid organization arrange spaces. **(20)**

7. Discuss 'Approach' and 'Form of Circulation Space' as elements of circulation. **(20)**

8. Describe the following spatial relationship: **(2×15=30)**

   (a) Space within a space

   (b) Adjacent spaces

L-2/T-2/ARCH **Date : 26/07/2016**

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

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

Sub : **CE 271** (Building Services I: Plumbing)

Full Marks : 140 Time : 3 Hours

The figures in the margin indicate full marks.

USE SEPARATE SCRIPTS FOR EACH SECTION

SECTION – A

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

1. (a) Write short notes on: (i) Stack pipe, (ii) Branch pipe, (iii) Back Flow, (iv) Air gap. **(13 1/3)**

   (b) What are the basic principles that must be followed in planning the soil and waste stack system within a building? **(10)**

2. (a) Which type of drainage plumbing system will you prefer for the following types of buildings: **(10)**

   (i) 3-4 storied group housing, (ii) Multistoried Hospital, (iii) 3-4 storied Hotels.

   Explain reasons in favor of your selection.

   (b) A six-storied residential building has 4 units on each level. Each unit has a gross floor area of about 1500 sft (including common space for lift, lobby etc). For rainwater drainage the building has two roof drains with interior leaders. The rainwater is finally discharged to a storm sewer network. Determine the size of interior leader, building storm drain and building storm sewer piping (Use Table attached). **(13 1/3)**

3. (a) Write short notes on (i) Soil pipe, (ii) Waste pipe, (iii) Trap, (iv) Water Seal. **(13 1/3)**

   (b) Why the Manholes are provided in the house drains? What are the considerations for determining the suitable locations of Manholes? **(10)**

4. (a) In diagram show the details of House Water connections and label the various components. Justify the rationale for inclusion of each of those. **(13 1/3)**

   (b) What is "Plumbing system" for buildings? What are the major components of it? What are the basic design objectives of each of the components of plumbing system? **(10)**

Contd P/2

CE 271/ARCH

SECTION – B

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

5. (a) What is a septic tank? Where and why is it required? Using a diagram, show the different components of a Septic Tank with a Soak Pit. **(10)**

   (b) Design a Septic Tank for a six storied residential building where 60 people reside. List the required assumptions. **(13 1/3)**

6. In a six storied apartment building at Dhaka, the ground floor is designed for parking vehicles while the other five floors are used for residential purpose. Each floor area is 1000 sft and there is only one toilet per floor. Design the underground reservoir, roof tank and pump for the building. Clearly mention the assumptions. Provide necessary drawings of the piping systems. **(23 1/3)**

7. Show the following plumbing systems of drainage with diagram: **(23 1/3)**

   (i) Single stack (ii) One-pipe system

   (iii) Tub-pipe system (iv) Partially ventilated one pipe system

   Mention the advantages and disadvantages of each of the systems.

8. (a) Write short notes on: (i) Sullage (ii) Sewage (iii) Night soil. **(6)**

   (b) What is Anti-siphonage pipe? Why is it required? What sort of situation may arise in a building due to the absence of anti-siphonage pipe in the system? **(9)**

   (c) List the principles governing design of water supply in buildings. **(8 1/3)**

TABLE . Sizes of Vertical Leaders and Horizontal Drains*

Vertical conductors and leaders		
Size of leader or conductor, in†	Maximum projected area, ft²	Flow, gal/min
2	2,176	23
2½	3,948	41
3	6,440	67
4	13,840	144
5	25,120	261
6	40,800	424
8	88,000	913

Horizontal building storm drains and building storm sewers						
	Maximum projected roof area, ft², and flow, gal/min, for various slopes					
	⅛ in per ft slope		¼ in per ft slope		½ in per ft slope	
Drain diameter, in	Area	Flow	Area	Flow	Area	Flow
3	3,288	34	4,640	48	6,576	68
4	7,520	78	10,600	110	15,040	156
5	13,360	139	18,880	196	26,720	278
6	21,400	222	30,200	314	42,800	445
8	46,000	478	65,200	677	92,000	956
10	82,800	860	116,800	1,214	165,600	1,721
12	133,200	1,384	188,000	1,953	266,400	2,768
15	238,000	2,473	336,000	3,491	476,000	4,946

Rainfall intensity 1 inch/hr for 1 hr duration

Figure for Question 2(b)

L-2/T-2/ARCH **Date : 31/07/2016**

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

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

Sub : **CE 267** (Structure II: Basic Mechanics of Solids)

Full Marks : 140 Time : 3 Hours

The figures in the margin indicate full marks.

USE SEPARATE SCRIPTS FOR EACH SECTION

SECTION – A

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

1. (a) A rod consisting of two cylindrical portions AB and BC is restrained at both ends as shown in Fig. 1(a). Portion AB is made of steel ($E_s = 29 \times 10^6$ psi, $\alpha_s = 6.5 \times 10^{-6}$/°C) and portion BC is made of brass ($E_b = 15 \times 10^6$ psi, $\alpha_b = 10.4 \times 10^{-6}$/°C). If the rod is initially under no stress, determine the normal stresses induced in AB and BC by a temperature drop of 50 °C. **(10)**

   (b) For the steel truss shown in Fig. 1(b), determine the axial stresses in member bc, ch, cg and gh; if all the member have a cross section of 2 in^2. Also compute the axial deformation of these members. Given that, modulus of elasticity, $E_s = 29 \times 10^6$ psi. **(13 1/3)**

2. (a) For the bracket shown in Fig. 2, determine the deflection at point B caused by the applied vertical force P = 3 kips. Given that, cross sectional areas of AB and BC are (0.25 × 0.50) and (0.875 × 0.25) respectively; and $E = 10.6 \times 10^3$ ksi. **(15 1/3)**

   (b) Derive the elastic flexural stress formula $\sigma = My/I$. **(8)**

3. (a) Prove that maximum shear stress in a rectangular section is 1.5 times the average shear stress over the whole section. **(16)**

   (b) Determine the number of bolts required and an appropriate layout, to transmit a dead load force of 80 kips and a live load force of 240 kips through two C 10 × 30 to a 1 in. gusset plate (Fig. 3). All materials are A36. Bolts are 3/4 in. A325 (standard holes) in a bearing type connection with threads excluded from the shear planes. Use three lines of bolts across the web of the channel. Use either AISC/ASD or, AISC/LRFD method and Annexure 1 for necessary data. **(17 1/3)**

4. (a) What do you understand by electrode identification code number EXXXXX? **(4)**

   (b) Design and draw the welded end connection required to transmit a total load (DL+LL) of 100 kips through an angle (L 3×3×1/4) and a gusset plate (thickness = 7/16 inch) as shown in Fig. 4. All materials are A36 and E60XX electrode is used. Use AISC/ASD method and Annexure II for necessary information. **(19 1/3)**

Contd P/2

CE 267/ARCH

SECTION – B

There are **SEVEN** questions in this section. Answer any **FIVE**.

Assume any reasonable value of missing data.

5. Define with sketch four types of internal resultants forces such as normal force, shear force, torsional moment and bending moment in a cross-section of a member. **(14)**

6. Draw axial force, shear force and bending moment diagrams for the beam loaded as shown in Figure 5. **(14)**

7. Draw axial force, shear force and bending moment diagrams for the frame loaded as shown in Figure 6. **(14)**

8. An aluminum specimen has a diameter of 20 mm and a gauge length of 200 mm. If an axial tension force of 120 kN elongates the gauge length 1.10 mm, determine the modulus of elasticity. Also, determine the contraction of the diameter due to the application of the force. Given G_{al} = 25 GPa and σ_y = 400 Mpa. **(14)**

9. A steel wide-flange beam has the dimensions shown in Figure 7 is subjected to a shear force V = 80 kips. Plot the shear stress distribution acting over the beam's cross-sectional area. **(14)**

10. What do you mean by ductile and brittle materials? Draw typical stress-strain diagrams of various materials such as rubber, wood, cast iron, aluminum alloy and mild steel in a single diagram. **(14)**

11. Write short notes on followings: **(14)**
    (i) Stress concentration
    (ii) Engineering stress and true stress
    (iii) Strain energy density
    (iv) Factor of safety

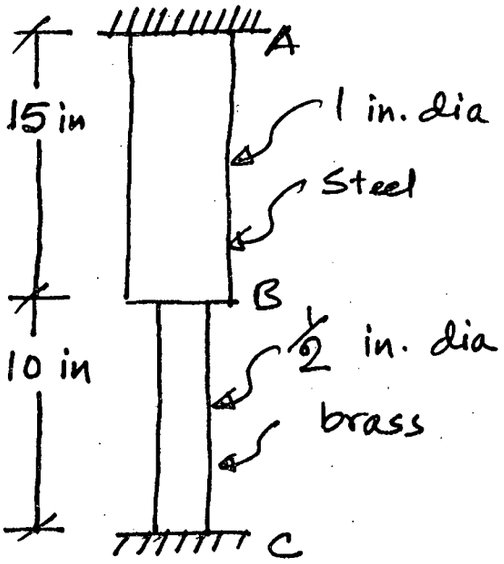


Figure : 1(a)

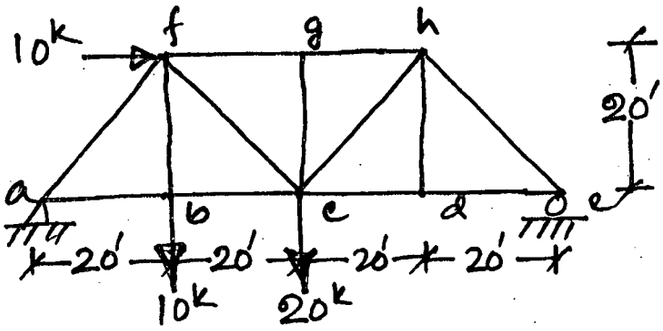


Figure : 1 (b)

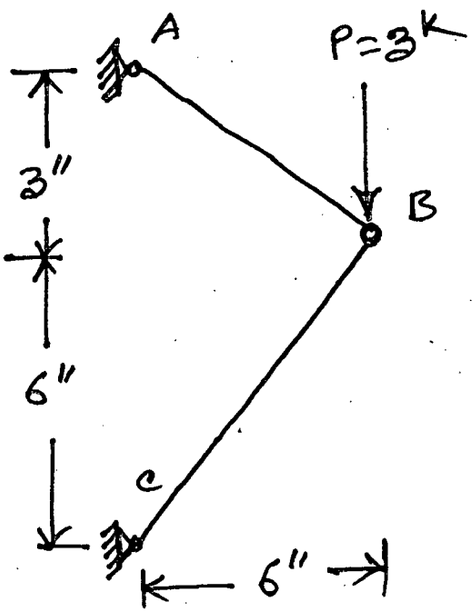
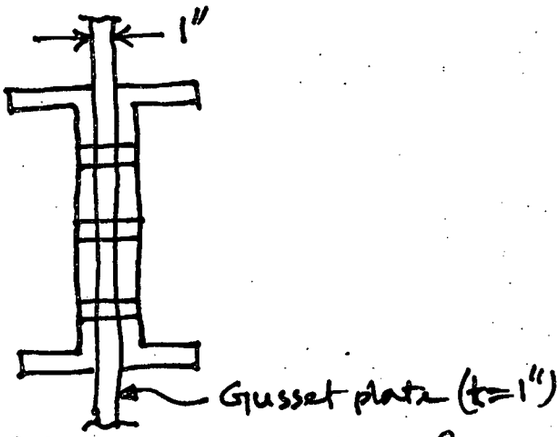


Figure : 2



Two C 10×30 channels
$A_g = 8.82 in^2$, $t_w = 0.673$ in.

Figure – 3

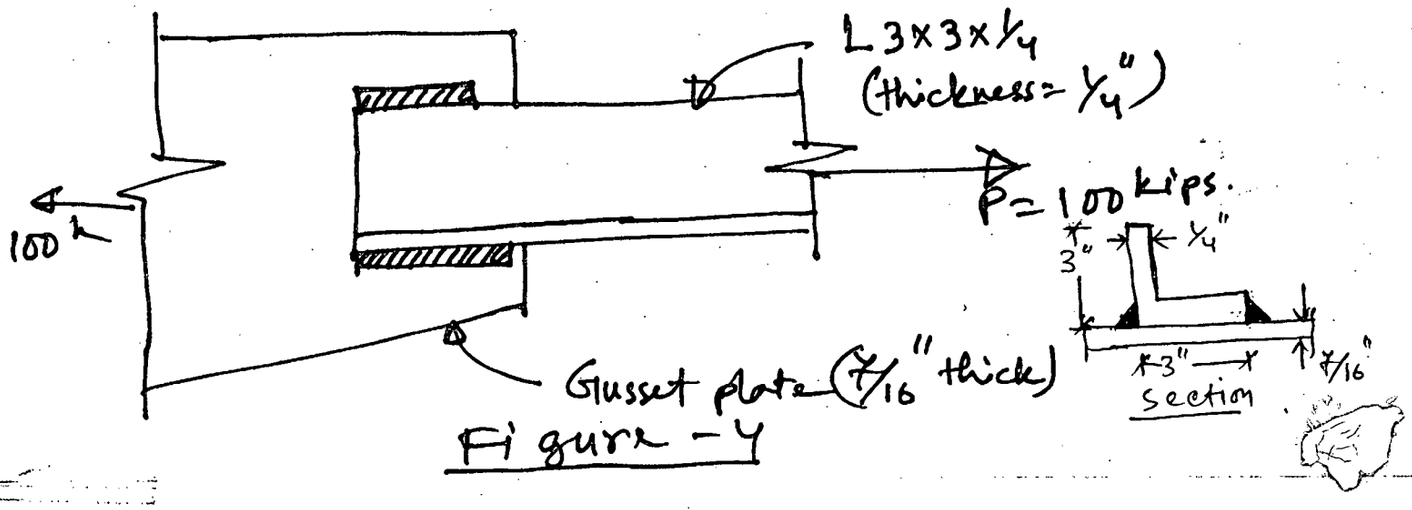


Figure – 4

ANNEXURE-I

...imum edge distance (standard

Nominal fastener diameter, in	Sheared edge	Rolled edge or gas-cut edge*
$\frac{1}{2}$	$\frac{7}{8}$	$\frac{3}{4}$
$\frac{5}{8}$	$1\frac{1}{8}$	$\frac{7}{8}$
$\frac{3}{4}$	$1\frac{1}{4}$	1
$\frac{7}{8}$	$1\frac{1}{2}$†	$1\frac{1}{8}$
1	$1\frac{3}{4}$†	$1\frac{1}{4}$
$1\frac{1}{8}$	2	$1\frac{1}{2}$
$1\frac{1}{4}$	$2\frac{1}{4}$	$1\frac{5}{8}$
Over $1\frac{1}{4}$	$1\frac{3}{4}$ × diameter	$1\frac{1}{4}$ × diameter

* All distances in this column may be reduced $\frac{1}{8}$ in if the hole is at a point where the stress in the element is less than 25 percent of the maximum allowed stress.
† These may be $1\frac{1}{4}$ in at the ends of beam connection angles.

TABLE 2-9
Allowable working stress* on fasteners or connected material (ksi)

Load condition	A325	A490
Applied static tension†‡	44	54
Shear on bolt with threads in shear plane	21	28
Shear on bolt without threads in shear plane	30	40
Bearing on connected material with single bolts in line of force in a standard or short slotted hole	$1.0F_u$‡§	
Bearing on connected material with two or more bolts in line of force in standard or short slotted holes	$1.2F_u$‡§	
Bearing on connected material in long slotted holes	$1.0F_u$‡§	

* Ultimate failure load divided by factor of safety.
† Bolts must be tensioned to requirements of Table 2-7.
‡ F_u = specified minimum tensile strength of connected part.
§ Tabulated values apply when the distance L parallel to the line of force from the center of the bolt to the edge of the connected part is not less than $1\frac{1}{2}d$ and the distance from the center of a bolt to the center of an adjacent bolt is not less than $3d$.

Source: AISC.

TABLE 2-11
Specification allowable stresses* for high-strength structural bolts (ksi)

	A325			A490		
Condition	AISC/ASD	AASHTO	AREA	AISC/ASD	AASHTO	AREA
Tension	44	39.5	44	54	48.5	54
Shear, slip-critical connection†						
Standard hole	17	16	17.5	22	20	22
Oversize hole	15	13.5	15§	19	17	19§
Shear, bearing-type connection:						
Threads in shear plane	21	19.5	...	28	25	
No threads in shear plane	30	27	...	40	36	
Bearing	$1.2F_u$‡	$1.35F_u$‡	$1.5F_u$‡	$1.2F_u$‡	$1.35F_u$‡	$1.5F_u$‡

* On unthreaded-body area, also called nominal area.
† Class A surface, clean mill scale.
‡ Ultimate strength of lowest-strength connected material.
§ Special permission by the engineer required.

TABLE 2-13
AISC/LRFD design strength of fasteners

	Tensile strength		Shear strength in bearing-type connections	
Description of fasteners	Resistance factor	Nominal strength,[a] ksi	Resistance factor	Nominal strength,[a] ksi
A307 bolts	0.75	45.0[b]	0.75	24.0[c,e]
A325 bolts, when threads are not excluded from shear planes	0.75	90.0	0.75	48.0[c]
A325 bolts, when threads are excluded from shear planes	0.75	90.0	0.75	60.0[c]
A490 bolts, when threads are not excluded from shear planes	0.75	113.0	0.75	60.0[c]
A490 bolts, when threads are excluded from the shear planes	0.75	113.0[c]	0.75	75.0[c]
Threaded parts meeting the requirements for materials approved by AISC, when threads are not excluded from the shear planes	0.75	$0.75F_u$[b,d]	0.75	$0.40F_u$
Threaded parts meeting the requirements for materials approved by AISC, when threads are excluded from the shear planes	0.75	$0.75F_u$[b,d]	0.75	$0.50F_u$
A502, Grade 1, hot-driven rivets	0.75	45.0[b]	0.75	25.0[c]
A502, Grades 2 and 3, hot-driven rivets		60.0[b]	0.75	33.0[c]

[a] Values in this column are approximately 80 percent of the ultimate shear strength. See Art. 3-11.
[b] Static loading only.
[c] Threads permitted in shear planes.
[d] The nominal tensile strength of the threaded portion of an upset rod, based upon the cross-sectional area at its major thread diameter, A_b shall be larger than the nominal body area of the rod before upsetting, times F_y.
[e] When bearing-type connections used to splice tension members have a fastener pattern whose length, measured parallel to the line of force, exceeds 50 in, tabulated values shall be reduced by 20 percent.

Source: Adapted from the 1991 AISC/LRFD Specification.

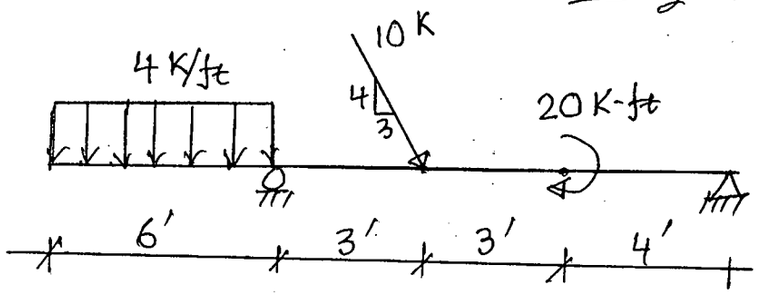


Figure : 5

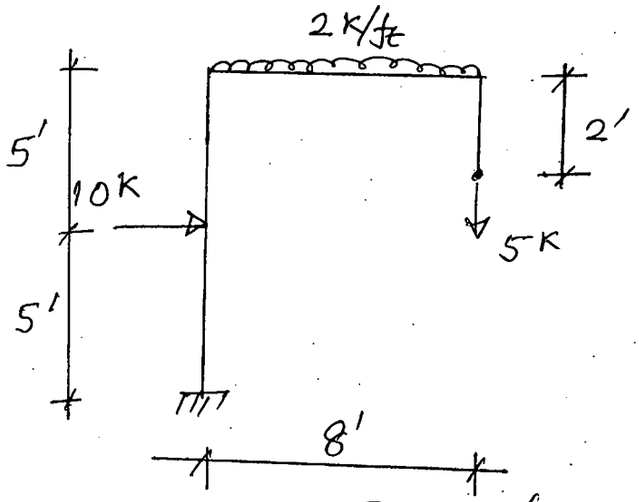


Figure : 6

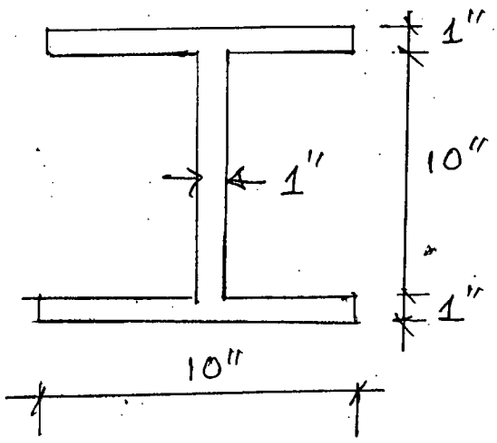


Figure 7

ANNEXURE-II

Table 1: 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
1/4	Over ½ to ¾
5/16	Over ¾ to 1½
3/8	Over 1½ to 2¼
1/2	Over 2¼ to 6
5/8	Over 6

Table 2: 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