ARCH 314
STRUCTURE I

RECITATION SESSION 8
FACULTY: Prof. Peter Von Buelow
GSI: Faezeh Choobkar
FALL 2025

Welcome to recitation session

Introduction:

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Outline:

Quick Recap
Provide the solution for the assignment
Answering student's questions
Recitation lab

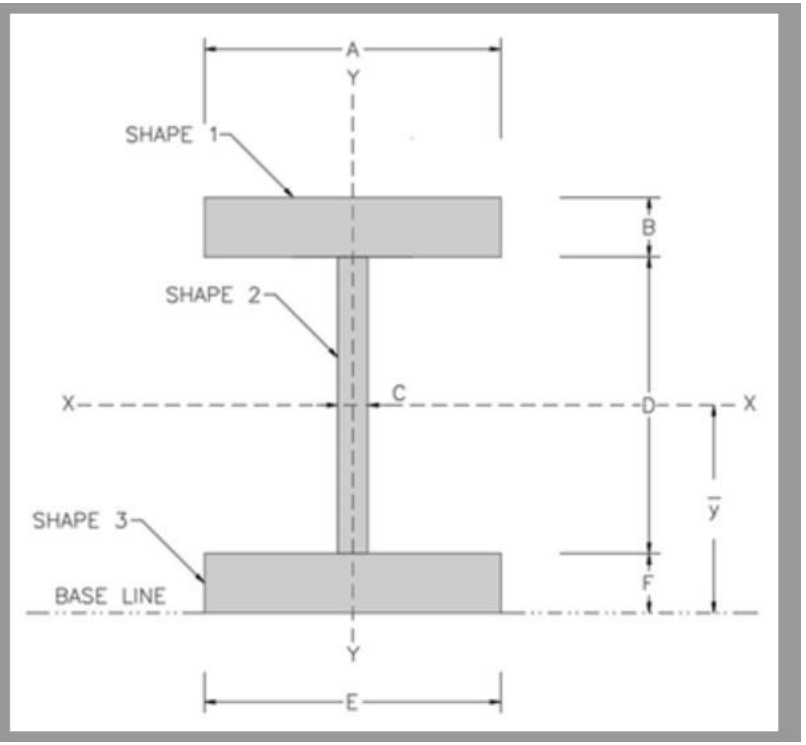
Problem Set

11. Moment of Inertia

Use the Parallel Axis Theorem to find the moments of inertia about both the x-x and y-y axes of the compound section.

DATASET: 1 -2- -3-

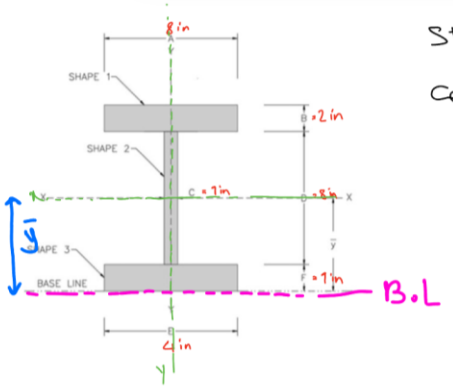
Dimension A	8 IN
Dimension B	2 IN
Dimension C	1 IN
Dimension D	8 IN
Dimension E	4 IN
Dimension F	1 IN



Problem Set

#	Question	Your Response		Correct Answer
1	x-x Moment of Inertia of shape 1 about its own centroid (Ixx)		IN^4	SUBMIT
2	x-x Moment of Inertia of shape 2 about its own centroid (Ixx)		IN^4	SUBMIT
3	x-x Moment of Inertia of shape 3 about its own centroid (Ixx)		IN^4	SUBMIT
4	Summation of x-x Moments of Inertia of all shapes (SUM Ixx)		IN^4	SUBMIT
5	Distance from the centroid of shape 1 to the centroid of the whole shape		IN	SUBMIT
6	Distance from the centroid of shape 2 to the centroid of the whole shape		IN	SUBMIT
7	Distance from the centroid of shape 3 to the centroid of the whole shape		IN	SUBMIT
8	2nd Moment of area 1 about centroid of whole shape x dist. to centroid (Ad^2)		IN^4	SUBMIT
9	2nd Moment of area 2 about centroid of whole shape x dist. to centroid (Ad^2)		IN^4	SUBMIT
10	2nd Moment of area 3 about centroid of whole shape x dist. to centroid (Ad^2)		IN^4	SUBMIT
11	Summation of moments of areas times distances to centroid (SUM Ad^2)		IN^4	SUBMIT
12	Moment of Inertia about the x-x axis for the whole shape (Ix)		IN^4	SUBMIT
13	y-y Moment of Inertia of shape 1 about its own centroid (Iyy)		IN^4	SUBMIT
14	y-y Moment of Inertia of shape 2 about its own centroid (Iyy)		IN^4	SUBMIT
15	y-y Moment of Inertia of shape 3 about its own centroid (Iyy)		IN^4	SUBMIT
16	Summation of y-y Moments of Inertia of all shapes (SUM Iyy)		IN^4	SUBMIT
17	Moment of Inertia about the y-y axis for the whole shape (Iy)		IN^4	SUBMIT

Problem Set



Step 1 :

Calculate the centroid of the Area

	A (Area)	Distance from base d	AXd
shape 1	8x2 = 16	$\frac{2}{2}+8+7=10$	160
Shape 2	8x1 = 8	$\frac{8}{2}+7=5$	40
Shape 3	4x1=4	$\frac{1}{2}=0.5$	2
SUM	28 in^2	—	202

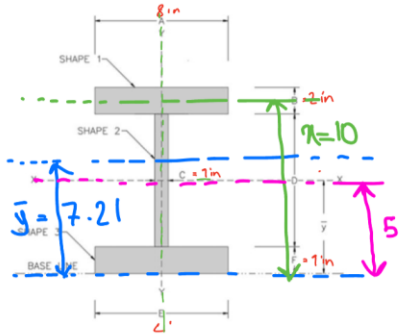
$$\bar{y} = \frac{\Sigma Axd}{\Sigma A} = \frac{202}{28} = 7.21 \text{ IN}$$

Problem Set

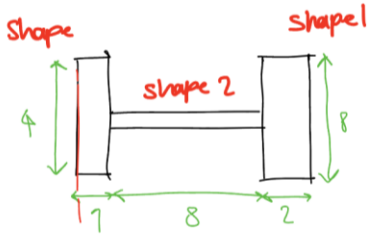
STEP2 : Second Moment of Area (I_x)
(Moment of inertia)

	I_x ($\frac{bh^3}{12}$)	A	d	Axd^2	I_x+Ad^2
Shape 1	$\frac{8\times(2)^3}{12}=5.33$	$8\times2=16$	$10-7.21=2.79$	124.54	129.87
Shape 2	$\frac{1\times(8)^3}{12}=42.66$	$8\times1=8$	$7.21-5=2.2$	39.07	81.73
Shape 3	$\frac{4(1)^3}{12}=0.33$	$4\times1=4$	$7.21-0.5=6.71$	180.09	180.42
SUM	48.32	28 in	–	343.70	392.02

d : centroid of shape to the centroid of whole shape



Problem Set



	$I_y \left(\frac{bh^3}{12}\right)$	A	d	Axd^2	$I_x + Ad^2$
shape 1	$\frac{2(8)^3}{12} = 85.33$	$8 \times 2 = 16$	0	0	85.33
shape 2	$\frac{8(1)^3}{12} = 0.66$	$8 \times 1 = 8$	0	0	0.66
shape 3	$\frac{1(4)^3}{12} = 5.33$	$4 \times 1 = 4$	0	0	5.33
SUM	91.32	28	—	-	91.32

$$\frac{I_x}{I_y} = \frac{392.02}{91.32} = 4.29$$

Moment of Inertia

Description

This project uses observation and calculation to investigate the moment of inertia.

Goals

To observe the strong and weak axis moment of inertia through physical testing.
To calculate the strong and weak axis moment of inertia for a given section.
To compare the physical sense with the calculated values.

Procedure

1. Span the given 1/16” x 1/2" basswood stick flatwise between two supports.
2. Load the ‘beam’ at mid span with your finger to cause about 1/2” deflection.
3. Now rotate the stick 90° so that it is on the narrow edge, and hold it in place.
4. Again with your finger apply about the same load as before, and notice how much stiffer the beam has become.
5. Now calculate the moment of inertia for both orientations – flatwise and on edge.
6. Compare the two numbers and observe how they relate to the actual stiffness you felt with your finger.

Moment of Inertia
of a rectangle

$$I = \frac{bd^3}{12}$$