ARCH 314
STRUCTURE I

RECITATION SESSION 3
FACULTY: Prof. Peter Von Buelow
GSI: Faezeh Choobkar
FALL 2025

TAUBMAN COLLEGE
ARCHITECTURE & URBAN PLANNING
UNIVERSITY OF MICHIGAN

Welcome to recitation session

Introduction:

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Outline:

Quick Recap
Provide the solution for the assignment (Problem set 3)
Answering student's questions
Recitation lab: Adding Forces

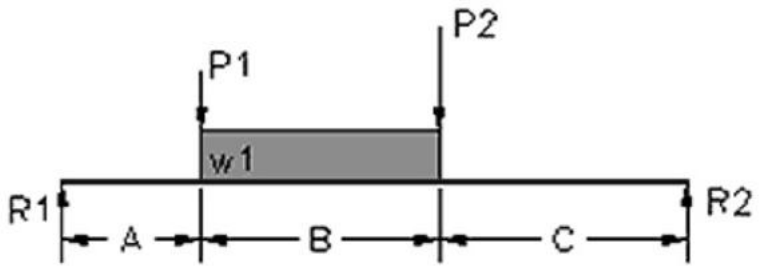
Problem Set 4 and 5

4. Parallel Force Systems

Sum the moments about each end of the beam to determine the end reactions of the parallel force system shown. Check that the sum of vertical forces is zero.

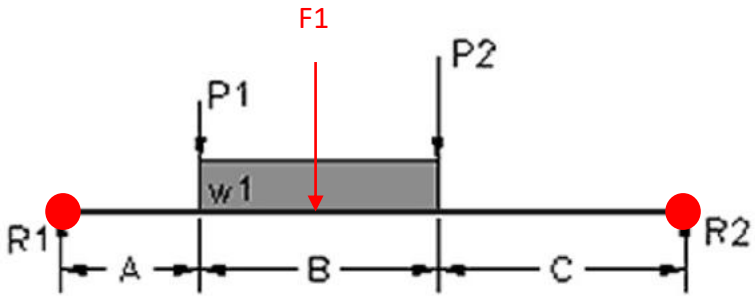
DATASET: 1 -2- -3-

Distance A	6 FT
Distance B	12 FT
Distance C	4 FT
Force P1	5 KIPS
Force P2	1 KIPS
Force w1	0.9 KLF



Problem Set 4 and 5

#	Question	Your Response		Correct Answer
1	Total force from distributed load: W1		KIPS	SUBMIT
2	Distance of total load W1 from left reaction		FT	SUBMIT
3	Total applied downward force		KIPS	SUBMIT
4	Left End Reaction (R1)		KIPS	SUBMIT
5	Right End Reaction (R2)		KIPS	SUBMIT



Q1:

W1= 0.9 KLF
DISTANCE B = 12 FT
Total force=F1= 0.9 × 12= 10.8

Problem Set 4 and 5

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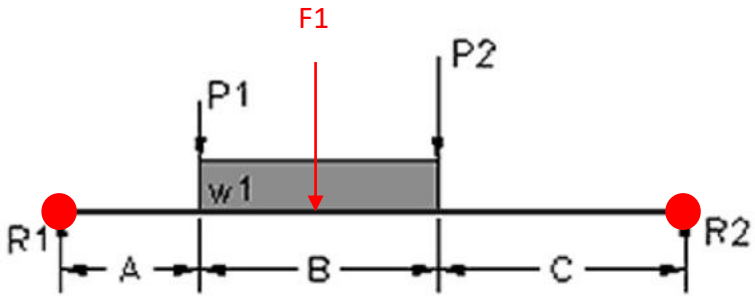

Q2:

Distance between F1 and R1:
Distance A+ Distance B/2 = 12 FT

Problem Set 4 and 5

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1	Total force from distributed load: W1		KIPS	SUBMIT
2	Distance of total load W1 from left reaction		FT	SUBMIT
3	Total applied downward force		KIPS	SUBMIT
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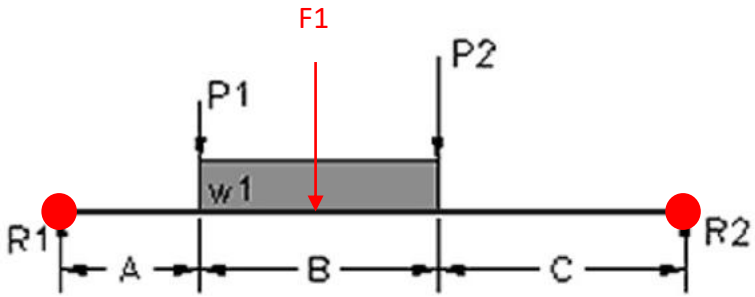

Q3:

Total downward force:
P1+P2+F1= 5+1+10.8= 16.8

Problem Set 4 and 5

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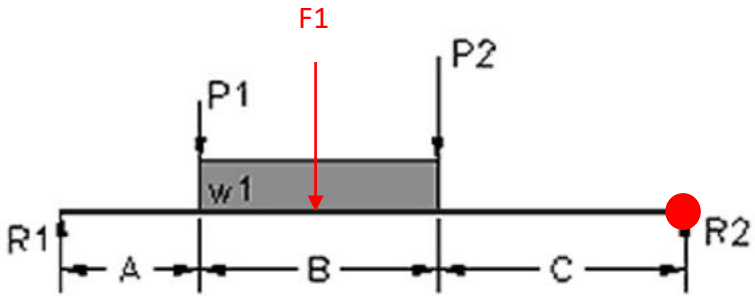

Q4:

Left end reaction:

$\Sigma M2=0$

$R1(6+12+4)- 5(12+4)-1(4)-10.8(10)=0$

$R1=8.73$

Problem Set 4 and 5

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2	Distance of total load W1 from left reaction		FT	SUBMIT
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4	Left End Reaction (R1)		KIPS	SUBMIT
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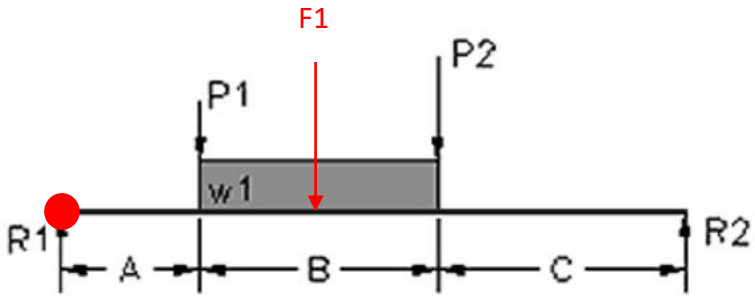


Q5:

Right end reaction:

$\Sigma M1=0$

$-R2(6+12+4)+5(6)+1(18)+10.8(12)=0$

$R2=8.07$

$\Sigma Fy=0$

$8.07+8.73-16.8=0$

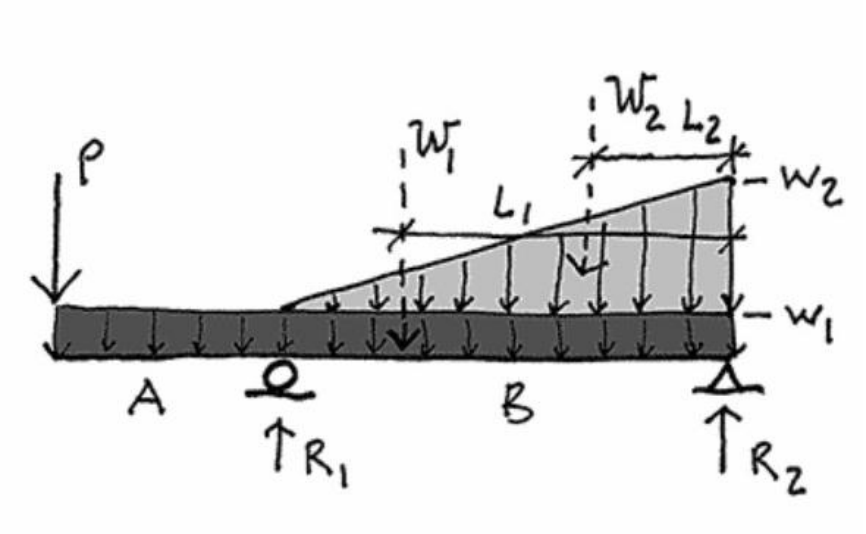
Problem Set 4 and 5

5. Equilibrium of Rigid Bodies

Determine the support reactions at A and B that will hold the beam in equilibrium.

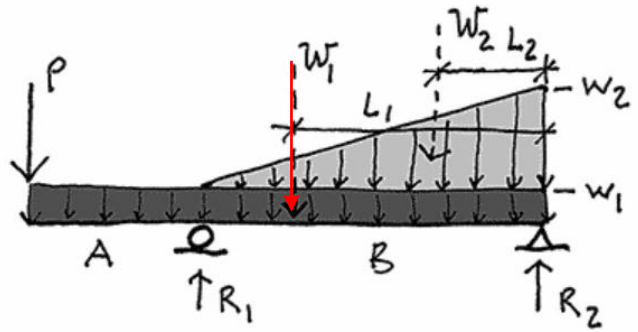
DATASET: 1 -2- -3-

Point Load: P	4.2 KIPS
Uniform Load: w1	180 PLF
Triangular Load: w2	520.8 PLF
Length A	6.3 FT
Length B	21 FT



Problem Set 4 and 5

#	Question	Your Response		Correct Answer
1	TOTAL force of the uniform load: W1		KIPS	SUBMIT
2	Distance from centroid of the uniform load to R2: (L1)		FT	SUBMIT
3	TOTAL force of the triangular load: W2		KIPS	SUBMIT
4	Distance from centroid of the triangular load to R2: (L2)		FT	SUBMIT
5	TOTAL load on the member		KIPS	SUBMIT
6	Reaction force: R1 (down is - : up is +)		KIPS	SUBMIT
7	Reaction force: R2 (down is - : up is +)		KIPS	SUBMIT



Q1:

W1×(A+B)= 180(27.3)=4914/1000=4.914 KIPS

Problem Set 4 and 5

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2	Distance from centroid of the uniform load to R2: (L1)		FT	SUBMIT
3	TOTAL force of the triangular load: W2		KIPS	SUBMIT
4	Distance from centroid of the triangular load to R2: (L2)		FT	SUBMIT
5	TOTAL load on the member		KIPS	SUBMIT
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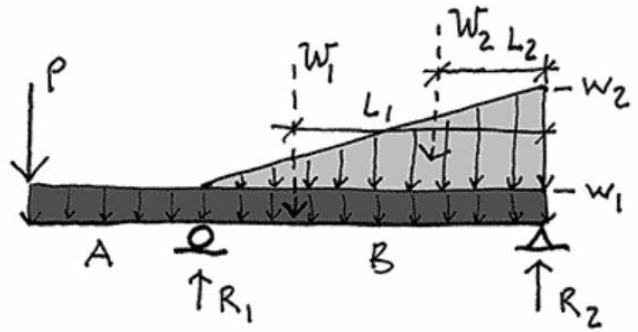

Q2:

L1=(A+B)/2=27.3/2=13.65

Problem Set 4 and 5

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1	TOTAL force of the uniform load: W1		KIPS	SUBMIT
2	Distance from centroid of the uniform load to R2: (L1)		FT	SUBMIT
3	TOTAL force of the triangular load: W2		KIPS	SUBMIT
4	Distance from centroid of the triangular load to R2: (L2)		FT	SUBMIT
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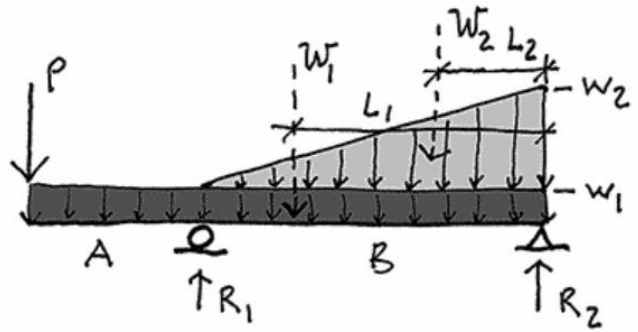

Q3:

520.8(B)/2=5468.4/1000=5.46

Problem Set 4 and 5

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2	Distance from centroid of the uniform load to R2: (L1)		FT	SUBMIT
3	TOTAL force of the triangular load: W2		KIPS	SUBMIT
4	Distance from centroid of the triangular load to R2: (L2)		FT	SUBMIT
5	TOTAL load on the member		KIPS	SUBMIT
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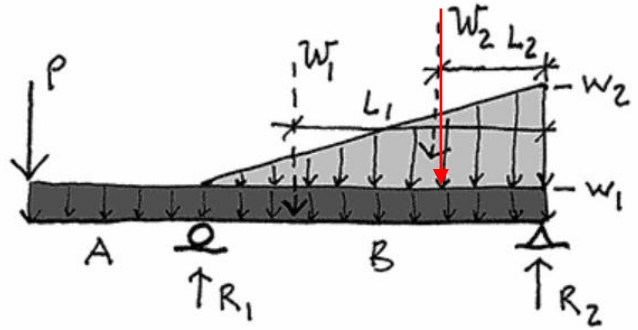

Q4:

DISTANCE B/3=21/3=7

Problem Set 4 and 5

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4	Distance from centroid of the triangular load to R2: (L2)		FT	SUBMIT
5	TOTAL load on the member		KIPS	SUBMIT
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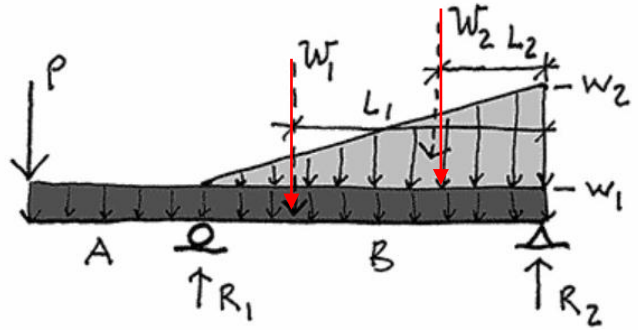

Q5:

TOTAL LOAD= P+W1+W2=4.2+4.914+5.468=14.582

Problem Set 4 and 5

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4	Distance from centroid of the triangular load to R2: (L2)		FT	SUBMIT
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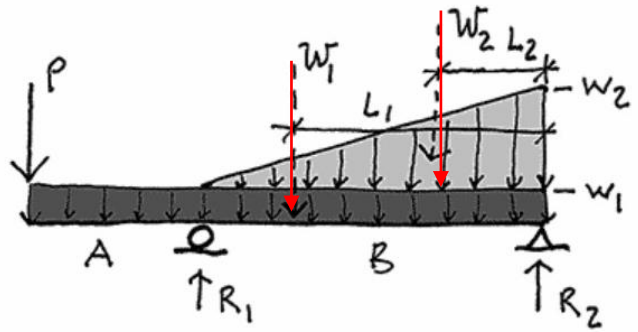

Q6:

Reaction R1:

Σ M2=0

-4.2(27.3)+R1(21)-4.914(13.65)-5.46(7)=0

R2=10.47

Problem Set 4 and 5

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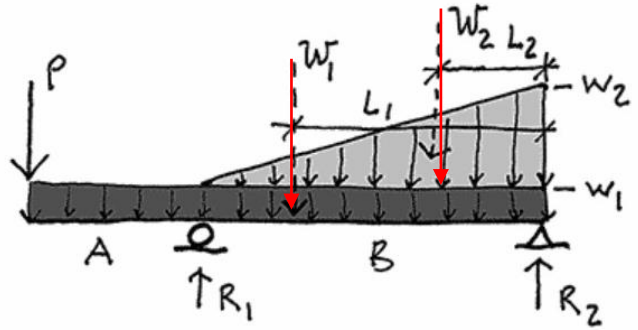


Q7:

Reaction R2:

Σ M1=0

-4.2(6.3)+4.914(7.35)+5.46(14)-R2(21)=0

R2=4.10

LAB

Balance occurs when :
total clockwise moment = total counterclockwise moment

$F1 \cdot d1 = F2 \cdot d2$

$\Sigma M = 0$

$\Sigma V = 0$

Name 3 _____

Equilibrium

Description

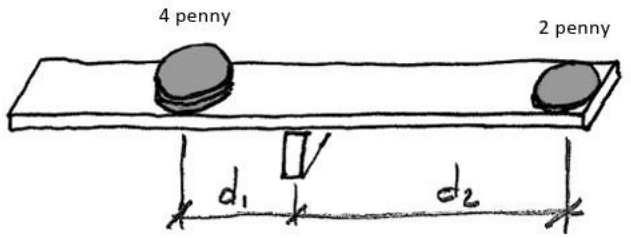
This project provides opportunity to experiment with the equilibrium of a balanced beam. It makes use of Archimedes' equations for forces on a lever to determine end reactions.

Goals

To observe balanced conditions using a beam balance.
To experiment with different combinations of balanced forces
To calculate the balanced forces using Archimedes' method

Procedure

1. Set up the beam balance with the fulcrum block at the center balance point.
2. Place 2 penny weights at one end. Use the ruled scale at the bottom of this page to measure the distance from the fulcrum to the center of the stack of pennies (d2). You can adjust the pennies to an even distance.
3. Calculate a point on the opposite side of the balance (d1) were 4 pennies will balance the 2 using Archimedes' equation. d2 x 2 = d1 x 4 so, d1 = d2 x 2/4
4. Place 4 pennies at your calculated distance d1 and verify that they balance the 2 pennies.
5. Calculate the moment caused by each stack of pennies around the fulcrum (in US pennyweight-inches).
6. Now, leaving the 2 penny stack at one end, spread the 4 pennies out next to each other and again find the balance point.
7. Observe that the center of the line of pennies still lies at d1 when the beam is balanced.
8. Finally, for the inverted case (point load on a simple beam) with P = 6 pwt at 2" from one end of the 12" beam, what would each end reaction be. Show this in a sketch.



Due

During recitation