Flipped IN-CLASS Lesson Plan Template

Topic or concept:

Internal forces

Basic objectives for preparatory work:

Students will be able to:

- Define internal loads concept wrt external loads
- Identify on a single-loaded concentrate force structure the 2 sections
- Estimate internal loads on a single-loaded concentrate force structure

Advanced objectives for classwork & after class work:

4 classes (1st class: multi-loaded concentrated forces, 2nd class: uniform distributed forces, 3rd class: distributed forces, 4th class: any combination of forces), for each class work and after class work will be:

◦ Class work

- Identify in a multi-loaded structure the different sections
- Estimate the internal loads in a multi-loaded structure
- Draw internal loads diagrams

◦ After class

- Improve understanding, and develop appropriation of the concepts on similar exercises to class exercise,
- Localize and evaluate the peak internal loads

Each class, 75 mins, will follow the same schedule:

	Time planned	Activity and rationale	Resources needed
Beginning of class period	5 mins	Time open to question on the prep-phase, *guided or based on the quizzes answers from preparatory activities*	None
	5 mins	Exercise solve by teacher based on preparatory activities. *Aiming at clarifying misconceptions and add info.*	Lecture prep – board (several colors of pencil is required for draws clarification)
	5 mins	Quiz (cahoot-like)	Computer or smartphone
Middle of period	5 mins	Presentation of a New problem related to class topic (see LAO above) and highlights on its differences with former exercises.	Video-projector + slides
	5 mins	Pair work to analyze the problem and identify the internal cut, and sections: *No calculation is expected*	
	5 mins	Class as a whole analyis of the problem to clarify misconceptions.	board (several colors of pencil are required for draws clarification)
	10 mins	Pair work to solve the problem and estimate the internal loads acting on every section.	
	5 mins	Collective correction of the problem.	board (several colors of pencil is required for draws clarification)
	15 mins	1 exercise assigned to each group of 5-6 students	Video-projector + slides
	5 mins	Flash correction of exercises (corrections written on slides is projected and commented, then corrections are provided online for students)	Video-projector + slides
End of period	10 mins	RSQC (Recall, Summarize, Question, Review, Comment). Students solidify understanding in preparation for doing advanced work at home.	Board + Video-projector + slides

Flipped AFTER CLASS Work Plan Template

Advanced learning objective	Activity and rationale	Instructions to students
- Improve understanding, and develop appropriation of concepts on similar exercises to class exercise, - Draw internal loads diagrams - Localize and evaluate the peak internal loads	- Training: analyze, and solve the problem to draw internal loads diagrams, and find peaks. *This phase provides training, and helps to appropriate, or consolidate new materials studied during class.* o Exercise 1: annotated exercise with internal sections, analytics solutions on each section, and peak values given o Exercise 2: annotated exercise with only peak values given. o List of similar exercises advised with numerical values annotated.	The aim of this after-class phase is to recall last class, improve, and make them your own concepts studied during class: - Training: o Solve exercises 1, and 2 without looking at the annotations. o Compare your solutions to the annotated solutions. o If you noted mistakes, try to understand and practice on similar exercises as listed
-	- Practicing: solve the problems, draw the diagrams, and quantify and localize the peaks of internal loads. *This provides practice in problem-solving.* o Problem 1: Completely annotated but the annotations contain 5 mistakes. Find the mistakes and provide a corrected version of the annotated exercise. o Problem 2: Partially annotated but the annotations contain mistakes. Find the mistakes and provide a corrected version of the annotated exercise and complete the exercise annotation. o Problem 3: Solve and explain each step.	- Practicing: *Exercises (5 students work of each) will be randomly collected* Solve and annotate problems 1, 2 and 3. You may work together; just be sure that YOU can solve and annotate problems independently as the exam will be similar to this work.

GUIDED PRACTICE CLASS 1[1]

Class:	ME 2510	Date assigned:	10/20/2019
Time estimate to complete: 1h – 1.5h		Date due:	10/26/2019

Overview/Introduction

The previous lessons of the ME 2510 introduced the concepts of external loads (forces and moments) applied to a structure. External loads might be related to applied external actions, or induced by joints to whom the structure is connected. Since the 2nd Newton's law (the equilibrium equations) is verified, the induced loads can be defined with respect to applied ones.

Indeed, external loads determination is required as this leads into internal loads which are related to internal stress and strain of the structure. Studying the reliability or the weaknesses of structure, and in a further step optimizing and designing them, requires to first estimate the internal loads.

The aim of this lesson, 2 weeks long, is to introduce internal loads, to learn how to estimate them, and to localize and quantify their peaks.

Learning Objectives

Basic objectives

- Defining internal forces concept,
- Defining the internal bending moment concept,
- Modeling an equilibrium between external and internal loads,

Advanced objectives

- Analyze a single-loaded concentrate force structure problem
- Identify the internal section and the 2 internal sub-domains of a single-loaded concentrate force structure problem,
- Solve a single-loaded concentrate force structure problem, and calculate the internal loads on each sub-domain,
- calculate on a single-loaded concentrate force structure problem the internal loads at specific locations.

Preparatory Activities and Resources:

1. Look at the video "4 types of internal forces": https://www.youtube.com/watch?v=d1fjGy8tas0
2. Read text book[2] Chap. 7, pp. 343-345.
3. Answer on canvas Quiz internal_forces-Q1 to evaluate your understanding. If the result is lower than 80%, go back to step 1, and then 2.
4. Look at the video "Introduction to internal forces": https://www.youtube.com/watch?v=SKE7-iEO4go
5. Train on text book, example 7.1 p. 346. Practice it without looking at the correct answer and then compare your result to the solution.
6. Practice on canvas on Quiz internal_forces-Q2, repeat it until all your answers are correct

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[1] Only Class one has a specific guided practice, Class *n* ($n \in \{2, 3, 4\}$) guided practice are indeed the "flipped after class" of class *n-1*

[2] Engineering Mechanics, Statics, R.C, Hibberler, Pearson Ed.,

7. Answer on canvas on Quiz internal_forces-Q3, you will be notified of your score without knowing which answer is wrong (if some are), and you will be allowed to repeat once.

Questions?

Remember that can you contact me during my office hours, or by email for any questions.

ADVANCED PRACTICE

This is given for students to complete after the class meeting in which they work together.

Class:	ME 2010
Date assigned:	Practice exercises and Homework on Monday, Practice exercises Thursday
Date due:	Thursday, noon for practice assigned on Monday, Monday noon of the following, for practice assigned on Thursday and homework assigned on Monday.

Time estimate to complete this assignment: 1h for each class (2) for the practice part, and 2h for the homework assigned once a week: total of 4h a week

Learning Objectives

Advanced objectives

1- Analyze & solve a problem of structure under static loads and calculate the internal loads applied within the structure,
2- Draw the 4 internal loads diagram,
3- Identify, localize, and calculate the peak internal loads within the structure

Activities & deliverables

1. Practice problem can be downloaded on canvas
    a. Problem 1:
    Completely annotated but the annotations contain 5 mistakes.
    Find the mistakes and provide a corrected version of the annotated exercise.
    Complete quiz internal_forces_W1(or 2)-Q1. One try only
    b. Problem 2:
    Partially annotated but the annotations contain mistakes.
    Find the mistakes and provide a corrected version of the annotated exercise and complete the exercise annotation.
    Complete quiz internal_forces_W1(or 2)-Q2. One try only
    c. Problem 3:
    Solve the problem.
    Complete quiz internal_forces_W1(or 2)-Q3. One try only
    and answer the and explain each step. Give detailed, action-oriented instructions for completing the assignment. Make sure to also include a reflective component.
2. Homework
    Complete homework, staple the pages together and title this assignment:
    "***Internal_forces_W1(or 2)***" along with your name and due date.
    This assignment is due in class on Monday 1 week after the homework has been assigned.

- Neatness and logical flow in your solutions is required.
- Analytical expression is expected before any numerical calculation.
- A Free Body Diagram must be drawn before solving each problem
- Every information must be provided to clearly justify each step. Lack of justification may lead to consider results as false.

Resources:

1. Statics: Lesson 56 - Introduction to Internal Forces, M, N, V: https://www.youtube.com/watch?v=AJC3TNdC-f0
2. https://ecourses.ou.edu/cgi-bin/ebook.cgi?doc=..&topic=st&chap_sec=08.1&page=theory
3. Statics Lecture 26: Internal forces -- Shear Force and Bending Moment Functions and Diagrams: https://www.youtube.com/watch?v=fRTZyTAo0ts

Questions?

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