



## 4013.315/Architectural Engineering Systems

Construction Engineering and Management Dept. Seoul National University

# Coat Stand\*

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### Scope

In this project, students will again design and build the project, in this case a coat stand. The project will give you the opportunity to follow the entire design process, since the problem/project is relatively simple. Specifically: Several concepts of the coat stand should be developed and selected based on the criteria you have formulated. Once this is done, you can proceed to detail design which also involves some simple analysis. You might possibly have to revise your concept during the detail design. Finally, you will build the stand. It is important that you consider this during conceptualization! For this project you will work in teams of three.

Your task is to build a coat-stand. The construction material will be wood as well as glue and screws for connections. In addition to this there will also be steel hooks. The wood pieces are considered to be raw material, i.e. you can cut them into any shape. In a first step each of you will after understanding the problem individually conceptualize a coat-stand. In a second step the group will finalize the conceptualization, select one of the designs, do the detail design and build one coat-stand.

### Task 1 - Design

First you are to create a design. The function of the coat-stand is, obviously, to carry coats, possibly also hats, scarves a.s.o. There are four basic requirements:

- 1) It must be safe against tipping over,
- 2) sturdy without being too heavy,

\*Adopted from MIT Courseware 1.012,

- 3) aesthetically pleasing and
- 4) economical.

In addition to this there are constraints concerning the available raw material:

The wood will be supplied in form of pine 1 by 4's (3/4" x 3 1/2" cross-section) and 1/8" thick plywood, You can only use up to 4 sqft of plywood. Also, you can use steel hooks.

As a result of your design, you should produce the following deliverables (see at the end of "Task 1" for the timing of the deliverables). Deliverable a) is first done individually, then a) - d) are done by the entire team.

- a) Sketch: Prepare a sketch of the proposed coat-stand. Try to do it three-dimensionally.
- b) Calculations: Present a calculation which „proves" that the coat-stand has an adequate factor of safety against tipping over. The „design coat", e.g. the heaviest load that the coat-stand must safely carry weighs 10 pounds. Write a short rationale, describing how you define the factor of safety, what you consider to be an adequate factor of safety and why. As a measure of how sturdy the coat-stand is, you should calculate the expected deflection  $d$ , when loaded with the „design coat". (Hint: arm, post and pedestal contribute to the total deformation: what will be the acceptable deflection limit for a coat stand? Especially if you have complicated shapes, it will be necessary to make a simplified calculation model. Use your engineering judgement! Again it is up to you, to define what acceptable deflections are. Write a short rationale, describing your assumptions and simplifications as well as your reasoning on what is sufficiently sturdy.

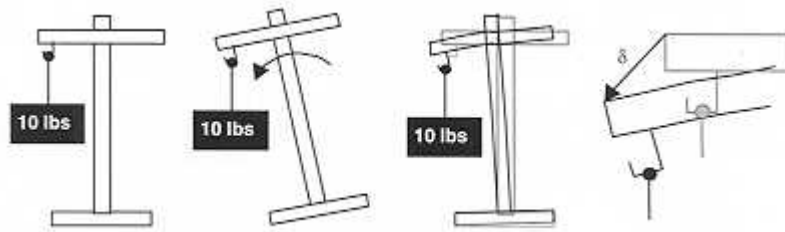
Hint: The Young's modulus of wood is approximately  $1.45 \cdot 10^6$  psi (10 GPa).

You can use the program "SAP2000" if required.

- c) Drawings: Prepare a plan view and a side view of the finished coat-stand. Then prepare a drawing of each piece of wood that you order and indicate,

how you cut out the necessary pieces.

- d) Order list: Make a list of the raw material you need. Specify the dimensions of the pieces of wood. Of course they must be compatible with the available sizes.



Each of you should start with sketching the coat-stand to define its approximate shape. While doing this you should also think about how you actually want to build it. Finally you should specify the dimensions and do the necessary calculations.

For the design which the group chooses to build, you also need to present drawings, the necessary calculations and an order list. Please do not try to build very difficult or impossible structures. Finally you should specify the dimensions and do the necessary calculations.

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## Task 2 - Building

To build the coat-stand you have to use the wood-shop. Before building the stand you must obtain the weight of the wooden parts.

Although varnishing and painting is not part of the assignment, you will later have the opportunity to do so.