Course and Syllabus Design
Gathering Background Information
Adapted from current and previous information at https://citl.illinois.edu/

When you plan a new course, a good first step is to gather as much background information as possible. The following information may be available from your department and colleagues.

Course Information

- What are the course goals? Why is this course important?
- Where does the course fit into the department's curriculum?
- What is the typical class size? How many contact hours?
- What prerequisites (if any) are there? Is the course a prerequisite to another course?
- Does this course have a particular reputation that you need to be aware of?

Student Information

- Who takes this course (structural engineering or other emphasis area, year in school, etc.)?
- Why do they take it? What do they already know about the material?
- What experience do they have with potential course methods (e.g. team projects, active learning, labs, technology)?

Resource Information

- Will you have teaching assistants available?
- What technology is available (and appropriate) for this class?
- Is a particular textbook required this class? What other textbooks might be good resources?

Another useful information-gathering strategy is to talk to others who have taught the course. Get copies of their files, notes, and exams, if you can.

Developing Course Content and Objectives
See "Designing with the End in Mind" at https://citl.illinois.edu/citl-101/online-strategy-development/develop-or-revise-an-online-course/online-course-in-a-box/designing-your-course

Once you have the background information you need, you should be ready to develop an outline of your course. Three components of the outline should be considered simultaneously: the content and objectives, how you make the content relevant and interesting to your students, and how you will assess their learning.

Many instructors begin this process by coming up with a list of topics to be covered in the course, often based on the sequence in the textbook. Others begin with the overall learning goals (course outcomes, objectives) and then work backwards, deciding on the assessments, topics, learning experiences, and teaching strategies would help student achieve the goals. In "backwards design," we:

1. Identify desired results
2. Determine acceptable evidence
3. Plan main learning experiences
4. Sequence course content around activities

Course outcomes are the broad goals you have for students—what they should be able to accomplish by the end of the course. In addition, specific course objectives can be written for specific units or lessons. **Bloom's revised taxonomy** is a framework that delineates six cognitive processes that increase in complexity, as seen in the following six questions about your intended learning outcomes.

Do you want your students to

- **remember** the material taught?
- **understand** it? (to translate, interpret, put into own words)
- **apply** it? (to use content to solve problems)
- **analyze** it? (to break down material into parts, detect relationships)
- **evaluate** it? (for a particular purpose, be able to make judgments about the value of ideas, solutions, methods, etc.)
- **create** something new from it?

Your targeted levels of the taxonomy should be easily detected in your course (and unit or lesson) objectives.

Resources

UIUC's Center for Innovation in Teaching & Learning provides additional information about syllabus design, assessment, teaching methods, books and journals on college teaching, and other topics. https://citl.illinois.edu/.

Your institution may have a similar website, with additional, university-specific suggestions or requirements for your course syllabus, etc., as on Oregon State's Center for Teaching & Learning website, under "Core Resources" (https://ctl.oregonstate.edu/core-resources), and Bucknell University's Teaching and Learning Center (http://www.bucknell.edu/TLC). In-person workshops and programs on teaching methods may also be offered.

Basic Philosophy and Overarching Goal?

We should be teaching a foundation of structural behavior and limit states, show how these fundamentals are realized in the Specification, and then transition to applications in a system context.

Remember – Understand – Apply – Analyze – Evaluate – Create

Course topics and their coverage at different universities, from a 2014 sample.

The tables are based on information provided for a recent semester for a particular instructor.

1st course topics	UArk	UIUC	Bucknell	UMass	Purdue	UW	CalPoly	Villanova
Introduction, properties, loads	Y	Y	Y	Y	Y	Y	Y	Y
Load calculations (e.g., ASCE 7)				Y	Y			Y
Structural design concepts	Y	Y	Y	Y	Y	Y	Y	Y
Tension members	Y	Y	Y	Y	Y	Y	Y	Y
Compression members (columns)	Y	Y	Y	Y	Y	Y	Y	Y
Flexural members (beams)	Y	Y	Y	Y	Y	Y	Y	Y
Beam-columns#	Y	Y	Y	Y	Y	Y	Y	Y
Basic bolted connections*		Y	Y	Y	Y		Y	Y
Basic welded connections*		Y	Y	Y	Y		Y	Y
Simple connections	Y		Y		S	Y		
Moment connections (fully-restrained)			Y		S	Y		
Partially-restrained connections						Y		
Frame stability			Y		S			
Eccentric Connections							S	
Seismic design							S	

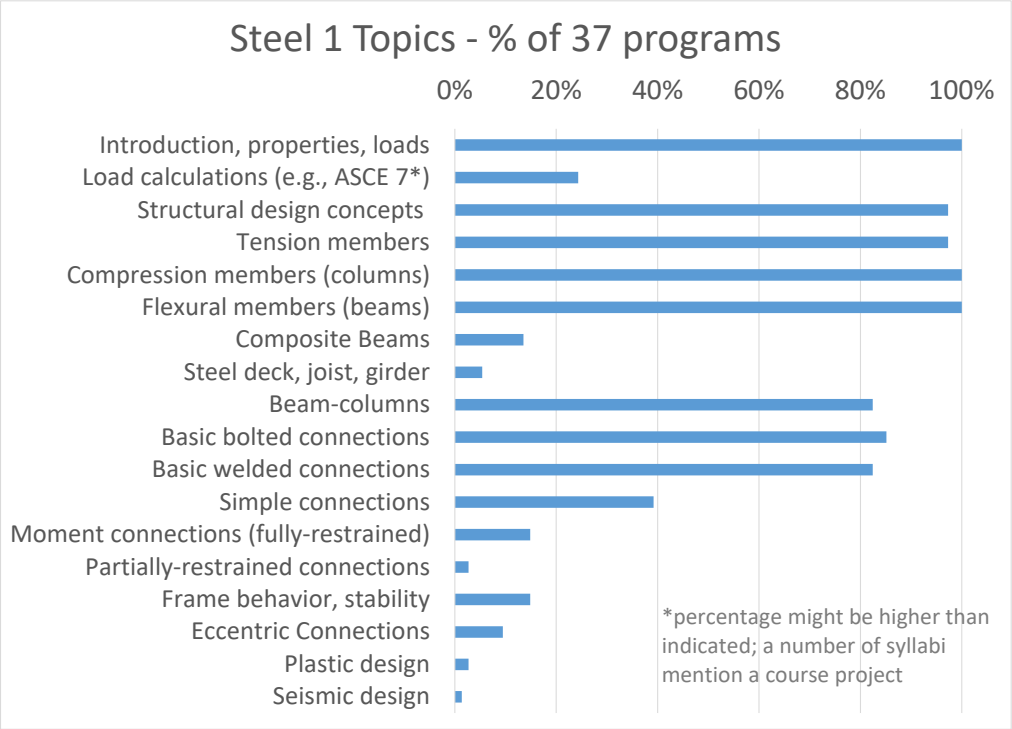
*Y – Yes, S – Sometimes or a very brief introduction; #braced beam-columns at UArk; *for tension members*

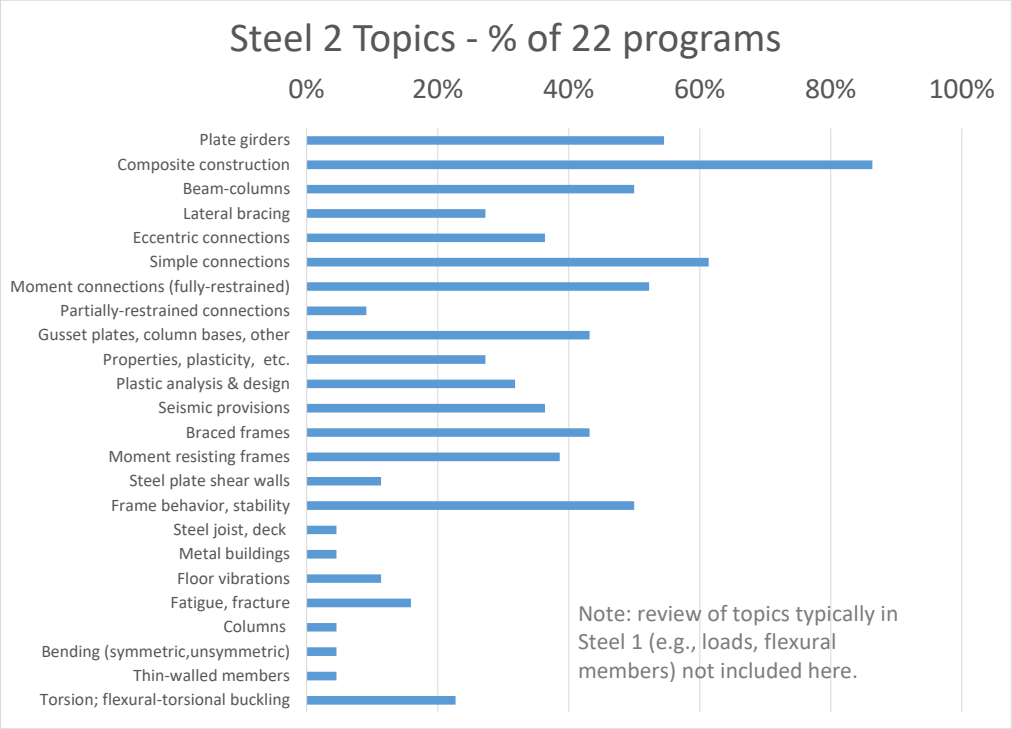
2nd course topics	UArk	UIUC	UMass	Purdue	UW	Villanova
Plate girders	Y	Y	Y	Y		
Composite construction*	Y	Y	Y	Y		Y
Beam-columns	Y	Y				
Lateral bracing		S	S	Y		
Eccentric connections	Y	S	S	Y		
Simple connections	Y	Y	S	Y		
Moment connections (fully-restrained)	Y	Y	S	Y		
Partially-restrained connections				S		
Gusset plates		Y		Y		
Properties, plasticity, etc.					Y	
Plastic analysis & design	Y				Y	Y
Seismic provisions					Y	
Braced frames		Y			Y	
Moment resisting frames		Y			Y	
Steel plate shear walls				S	Y	
Frame stability		Y		S	S	Y
Floor vibrations			S			
Fatigue			S			
Columns						Y
Bending (symmetric and unsymmetric, etc.)						Y
Thin-walled members (shear stresses)						Y
Torsion (open and closed thin-walled sections)						Y

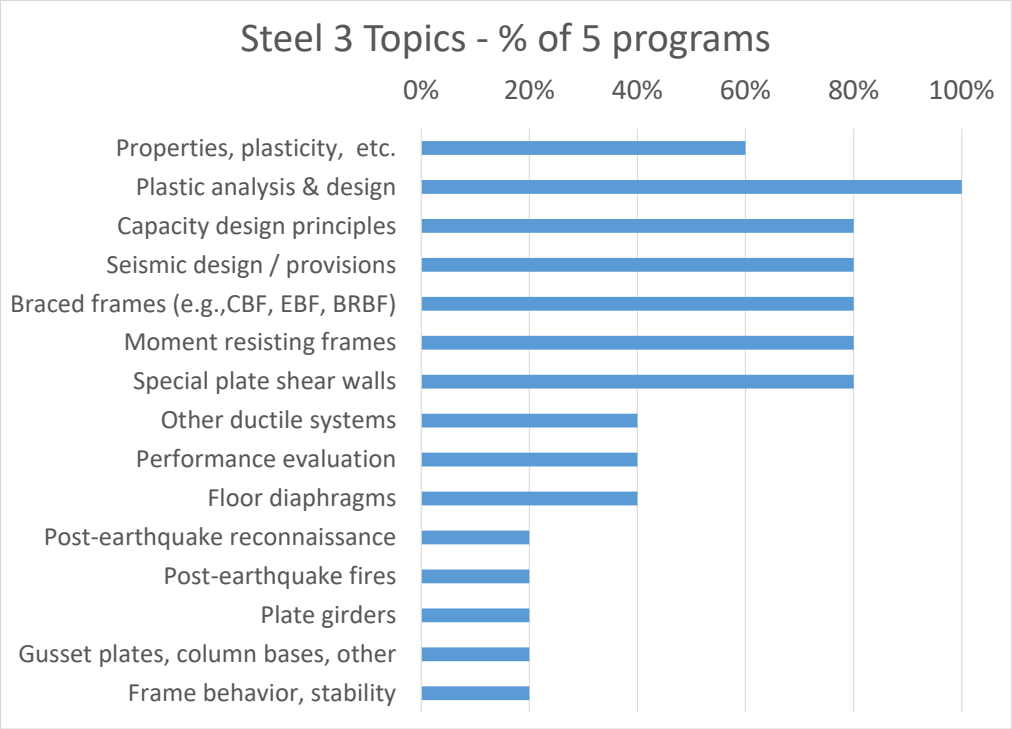
Y – Yes, S – Sometimes or a very brief introduction

**may have a focus on floor systems, but can also include composite columns and composite beam-columns*

Another summary of course topics - 2014 sample + contributions from 2018 workshop participants.







Some observations on course topics and syllabi*:

1st courses in structural steel design are fairly consistent across institutions in terms of coverage of topics such as tension members, compression members, and flexural members. 2nd course topics are much more variable, although composite construction (specifically, composite beams) appears on the syllabi of over 80% of the programs.

2nd course topics depend on what is offered in the 1st course at that institution, and if there are other steel courses offered (e.g., fatigue and fracture; seismic design of steel structures). There also seem to be some regional preferences for 1st and 2nd course topics, as well as some differences related to semester or quarter system. Meanwhile, the relatively small sampling of 3rd courses showed some preference for seismic design of steel buildings as the primary topic area.

In the 2nd course, portions of the syllabus may be intentionally vague – e.g., "overall structure considerations" and "other topics"; in one semester at UMass, these topics included floor vibrations, connection design, bracing requirements, and fatigue, as well as a semester team project.

Some programs require the AISC manual in the 2nd course, do not require any specific textbook, and list some reference or optional textbooks on the syllabus.

Some observations on exams:

In-class exams seem to be more common, but some instructors do take-home exams.

Many utilize short answer questions to test knowledge about concepts, behavior (requiring text and perhaps simple sketches); these questions may be separate or integrated into questions also requiring calculations.

**Sample syllabi can be found on the AISC Educator Forum; go to File Sharing and find the "2016 AISC Educator Workshop" folder!*

Some observations on exams, cont'd.:

Some do open book exams, or open AISC manual only. Others give closed book exams (or a combination; closed book may be only for short answer questions).

Some permit a note sheet (with requirements such as no solved examples, and/or submission of note sheet with exam)

One might provide line diagrams with boundary conditions, loads, etc. specified, or provide photos or drawings of buildings with descriptions, requiring the student to establish the boundary conditions and loading.

Axial forces, shear forces, and/or moments may be given, or students might be asked to do some analysis (e.g., truss analysis to determine controlling load combination for a member).

You should be able to write out the exam solution in approximately 1/4 to 1/3 of the time allotted to the students. Therefore, exam questions need to be more 'focused' than most homework problems. For example, ask about specific limit states, giving assumptions that other limit state capacities are adequate. Ask students to size a beam for moment capacity, but just check whether or not deflection limit is satisfied. Ask only for a weld size for a welded flange plate moment connection. One might also provide certain section properties or dimensions (rather than requiring students to calculate moment of inertia or look up d, b_f, t_f, t_w, etc., in the Manual).