

## ARCH 631. Questions from Lectures of Exam 1

### Lecture 1

1. The definition of a structure emphasizes the interrelationship of parts to make a whole. There are more than one classification system of the parts and the assemblages, like shapes & behavior of deformations (stiffness), aggregation ordering & materials.
2. Design criteria are what must be met when evaluating the structural performance of a complete system. What are they? Can you tell when they aren't met?

### Lecture 2

1. What are serviceability, strength, and economy?
2. What are the load classifications? What are the responses to dead vs. live vs. dynamic? Where do they come from? How are they oriented? What do they cause in our structural members and systems?
3. Can you determine a weight from a density? A distributed load from a tributary area and beam spacing?
4. What is the difference between an external force and an internal force?
5. Do you know how to model supports?
6. Do you know how to model a beam, a column, a truss?
7. Do you know how beam, columns, truss, etc. deform (or why)? Do you know how changing the load changes the deformation?
8. Do you know how to find the different type of forces that are important for the different types of members and connections?
9. What is stress? What is strain? How are they related?
10. How are materials different or similar with stress-strain relationships? What is brittle, ductile. or semi-brittle?
11. Do strains always cause stresses?
12. What action would you take if the beam deflects too much with respect to member shape, or member material?
13. What is buckling dependent upon?
14. Can you find length change due to temperature? Or the temperature from the change?
15. Can you find a resultant force on a point?
16. Can you find a resultant moment of a force about a point?
17. Can you find support forces and pin forces from rigid body and system equilibrium?
18. Can you find strain or length change due to a force/stress? Can you find the stress/force from a length change?

### Lecture 3

1. Again, can you identify the general structural requirements of a design? Do you know what strength requirements are vs. stiffness requirements?
2. Can you identify the major steps in the design process? Are any dependent upon the others? Are they in a step 1, step 2 sequence all the time? What is the difference between analysis and evaluation? Or the difference between preliminary and the final design? Why plan?
3. Do you know what a design method or methodology is? What is Allowable Stress Design and limit state design? Why are there different methods? How do they depend on loads and materials?

4. Where do our loads come from?
5. Can you model the loads on a structural element from load tracing?
6. What are load combinations and why are they necessary?
7. What is a Building Code, Zoning Ordinance, Materials Standards, and a Structural Design Code? Why do we have more than one? How are they related to each other?
8. Where do the minimum required loads come from? What is the use of a live load reduction factor?
9. What is the list of things out of the designer's control?
10. What is the list of things in the designer's control?
11. What does design methodology mean? What is one of the design methods used for steel or concrete or timber? How is the method related to material behavior in stress vs. strain?
12. Do you know what yield stress, elastic modulus, plastic range, ultimate strength, and proportional limit mean for steel (or concrete or timber....)?
13. Do you know what brittle and ductile mean?
14. Do you know what relationships we use for evaluating stress or strain for any type of material?

#### Lecture 4

1. What materials (by code) use Allowable Stress Design? What materials use Limit state design (LRFD, ultimate strength design)?
2. What are the limiting stresses in reinforced concrete beam design?
3. What is plastic design for steel beams? How is a plastic hinge a problem with stability?
4. Do you know the stress types to design with for beams? Do you know the serviceability issues?
5. Why is the maximum bending moment important in design?
6. Do you know the difference between section modulus (S) and moment of inertia (I)?
7. Can you identify the reason for lateral buckling in beams?
8. How is the deflection and bending moment in continuous beams different or similar to simply supported beams? What if the supports are moved in, like in an overhanging beam?
9. What is an effective length in a beam? (How is it different to an effective length of a column?)
10. What is partial loading of a continuous beam?
11. Can you find maximum bending moment off a diagram (or know where to calculate it given a shear diagram)?
12. Can you find bending stress? Or find the maximum moment allowed or the required section modulus?
13. Can you trace loads to a beam and find support forces, maximum shear, or maximum moment? Can you put the loads on the next supporting element properly?
14. Do you know how to find maximum moment when there is a uniformly distributed load?
15. Can you compare working stresses to allowable stresses in bending and shear for a rectangular section? Do you know what it takes to calculate deflection and can you compare it to allowable deflection?
16. Can you select a steel beam finding (or knowing)  $S_{\text{required}}$  that is the most efficient?

Lecture 5

1. What makes a truss suitable for long spans?
2. How do we model the members in a truss? The connections?
3. What is a “space truss”?
4. Why is it recommended to connect the columns to a space truss at multiple points?
5. Are there a limited number of configurations a truss can take on? Are there common shapes?
6. Can you model a parallel chord truss by an analogy to another type of structural member?
7. Why is a Vierendeel truss not a truss in the structural sense?
8. What is the advantage of a 3D truss (that has a cross section with “width”)?
9. Is lateral stability an issue?
10. What is the difference between crushing and buckling of a column? How do we decide which will govern the structural design?
11. What does  $P_{critical}$  mean?
12. Why is  $KL/r$  useful when having multiple column sections to choose from?
13. How do end conditions affect the buckled shape of a column?
14. What is the reason for bracing? What does the weak axis and strong axis mean?
15. What is the difference between Long, Intermediate, and Short columns in terms of design and behavior?
16. Do you know what a critical buckling load is and what affects it?
17. Can you find the governing load for a braced column?
18. Can you compare compression stress to allowable stress?
19. Do you know how to draw the method of sections? Can you solve for a truss member using a moment equation and where to sum?
20. Can you determine the tensile direction of a web member?

Lecture 6

1. Do you know the primary stresses in a cable and the limits?
2. What is special about the geometry of a straight cable? A draped cable? How do loads make the cable change shape?
3. Can you categorize the shape of cable structures?
4. What is the function of a cable-stay?
5. What are the parts of a tensegrity structure?
6. What is “line of action” and “crown” with respect to an arch?
7. Why do arches need stabilization? How can an arch be stabilized? How can a vault be stabilized?
8. Do you know the difference between a 2-hinged, 3-hinged, and a fixed-end arch and how the behavior is different or the same?
9. What are the primary stresses (and locations) in a dome?
10. Where is the largest force in a draped cable? In a parabolic arch? The smallest force? How is the analysis similar?
11. Do you need depth (sag) for a long span cable?
12. Do you know what other elements are necessary to support or anchor a cable?
13. Can flutter in a cable be eliminated?
14. Can arches bend?
15. What is the size of thrust in a uniformly distributed cable? What is the size a uniformly loaded arch?
16. Can you find a resultant maximum force at the supports of the cable and arch in question 15?