ARCH 631. Questions from Lectures of Exam 2

Lecture 7

1. What is the definition of a rigid frame? Are they usually statically determinate?
2. What are the primary stresses in a horizontal member vs. a vertical member?
3. What is an inflection point and why is it of use in analysis?
4. How do the member sizes compare to pinned frames (or posts and beam systems)?
5. What is the primary advantage to design with a pinned frame? The primary disadvantage?
6. What is "The Portal Method"? "The Cantilever Method"? The difference between them?
7. How can you "move" the location of the inflection points with respect to the member sizes?
8. How can load combinations affect the design with respect to bending moments and locations?
9. What is a Beam-Column? What is combining stresses? (Which stresses get combined?)
10. What is an interaction formula or diagram used for?
11. What effect does P-Δ (delta) have on the bending stress of a beam-column?
12. What is redistribution of moment?
13. What is "stiffness" related to?
14. What is sidesway? Can it happen with a vertical load or do lateral loads cause it?
15. Is it acceptable to "shape" the frame members? Why would you want to do it?
16. Can you identify rigid joints by construction and material? Can you have rigid joints with timber?
17. Can you draw a shear and bending moment diagram from given approximate analysis equations? Can you combine stresses?

Lecture 8

1. What are the primary stresses to design for in plates, slabs, and grids?
2. How is a grid different from a slab?
3. Can you label a system type when you see the beam-joist or slab configuration?
4. Can you distinguish a slab from a plate?
5. What kind of supports can you have for plates and grids? And how does the support affect the behavior and sizes of stresses we design for?
6. How do we model one-way plates? How do we model two-way plates?
7. Do you know what curvature means, and how it relates to the size of the bending moment?
8. Can you identify moment redistribution and know what moment size is being redistributed?
9. Can you look at a support type and determine if the moment is going to be redistributed?
10. How does the aspect ratio help us determine how to model plate behavior?
11. How does minimizing bending moment affect the required depth of the slab?
12. Can you look up a moment equation for continuous beams and plate support types from aspect ratio and calculate it?
13. What are design considerations for slabs (with respect to supports, continuity, minimum depth, span, load types, economics, lateral load resistance)?
14. How do space frames behave and how do we model that behavior?
15. What are important design concerns for space frames with respect to construction and supports?
16. Can you calculate the equivalent tension or compression in a space truss chord knowing the moment or tributary width?
17. How do folded plates resist bending (or do they)?

18. What are the important design concerns of folded plates with respect to compression and stiffness?

Lecture 10

1. Can you use the proper terms for concrete construction on-site, off-site, with different types of reinforcement and pre-or-post stressing?
2. Do you know what goes into making concrete?
3. Do you know the names of reinforcing steel, what grade means, and what development length, anchorage and splices are for?
4. What are the important material properties of concrete (with respect to compressive strength, durability, fire-protection, cost)?
5. What are the material properties that aren't so great (with respect to density, need for reinforcement, tensile strength, creep)?
6. How do we accommodate the properties that aren't so great (with respect to reinforcement, prestressing, stirrups, shear heads)?
7. Why would we want to "transform" steel into concrete in flexure design?
8. What is meant by ductile behavior of a reinforced concrete beam? What is brittle behavior? How is this related to under-reinforcing and over-reinforcing?
9. Can you identify the stresses or forces in a section stress diagram? Do you know what a, d, ρ, f'_c, f_y, b and A_s are?
10. Can you calculate the ultimate compressive capacity of the concrete (C), and the ultimate tensile capacity of the steel (T)?
11. What determines the nominal moment capacity of a reinforced concrete beam? How do we compare the capacity to the design moment?
12. Do you know where the stresses are in a T section?
13. What determines the nominal shear capacity for one-way or two-way shear? How do we compare the capacity to the design shear? What is the allowed maximum design shear (one-way)?
14. How do we determine if we need stirrups?
15. When we calculate deflections for reinforced concrete using ultimate strength design, what loads do we use to compare to live load and total load deflection limits?
16. What is the difference in spiral and tie reinforcement in columns by shape and influence on strength capacity?
17. Is the effective length of a column in a monolithically cast frame the same length as the column?
18. Can you see the influence of P-Δ in an interaction curve (reduction of allowed P with increase in M)?
19. What is special about the design of T beams? Where is the compressive stress? How wide is the compressive stress (and how deep)?
20. How do we squeeze stirrups into narrow one-way joists?

Lectures 11 & 12 (Case)

1. Why are there minimum depths allowed of reinforced concrete slabs and plates? (not in the book, but in my note set and related to fire protection)?
2. Do you know what is meant by clear cover or "cover"?
3. Can you choose design moment and shear equations for one-way continuous slabs? For continuous beams? For two-way continuous slabs?

4. Can you calculate the design moments (LRFD) and divide by the strip width?
5. Do you know what the design variables are for a concrete beam, and what methods/aids can help?
6. Can you use the R_n chart to find ρ (reinforcement ratio) and area of steel? Can you find the final reinforcement ratio and compare the moments and reinforcement ratios?
7. Can you find A_{smin} and determine if the area of reinforcement is within limits?
8. Can you use an area/ft width chart to select bars?
9. Can you calculate the shear capacity for one-way and two-way shear?
10. Can you determine the stirrup spacing?
11. Can you calculate the design shear for one-way and two-way shear?
12. Do you know what two-way punching shear is? Can you identify where the shear perimeter is (relative to the column and drop panel)?
13. Can you identify why the reinforcement in a slab is on the top or on the bottom (or both)?
14. Can you calculate the axial load capacity of a rectangular (or circular) column?
15. Can you use an interaction diagram to choose reinforcing for a specific column size and concrete strength (P_u, M_u)?
16. Do you know what "Live load reduction" is for?
17. Can you calculate a live load reduction?
18. Do you know what a middle strip and column strip are?
19. Can you load trace a lateral load from a wind pressure distribution?
20. Can you factor loads and include self weight?

<u>Lecture 13</u>

1. Can you relate "membrane" to pressurized systems and classify those systems?
2. What is the problem with wind loading on pressurized systems?
3. What are some solutions to the problem with pressurized systems (with respect to shape, span, pressure, etc.)?
4. What are the differences in membrane types by construction, loads, spans, containment, etc.?
5. How do we model the stresses in an air-inflated structure (like what other system)?
6. What happens in each type of membrane system when stresses are exceeded? Are there special provisions for if the member deflates and is no longer lifted "up"?
7. Can you relate "net" or tent structures to tensile/curved systems and classify those systems?
8. Can you identify the types of stresses to design for in membranes and nets?
9. Do you know where the largest stresses are in tensile structures?
10. Do you know how tensile structures (not in tension) are supported and stiffened?
11. What are the requirements of a material for strength and serviceability to be used for a membrane or net?
12. Can you identify a shell from a dome or vault? What is the primary difference in terms of thickness and stresses?
13. Can you name any of the shape classifications?
14. What loads are appropriate to use with shells?
15. Where are the tensile stresses in a semi-spherical shell with orientation? Where are the compressive stresses with orientation?
16. What stresses or forces must a ring at the base of such as shell resist? What stresses or forces must be resisted at the crown?
17. How does changing the support conditions at the base of this kind of shell change the deflection and moment size? What technique (other than the support type) can we use to "stiffen" the structure to reduce deflections?

18. Can you describe local buckling in a shell? How is it different from "snap-through"?
19. Can shells resist lateral loads well? Can you relate this to the stresses?
20. In a hyperbolic parabaloid with uniform loading, can you identify which parts see tension and which see compression by the curvature?
21. Do you know why a fabric would be coated for use as a membrane material?
22. Are fabric material properties linear-elastic in all directions?
23. What is a common structural model to use when evaluating shell stresses?
24. Can you calculate an internal tension of a sphere and a hoop (circle) and determine a stress to use for design?
25. Can you calculate the meridional force (per unit length) and stress, and the hoop force (per unit length) and stress for a distributed load (w)?

Lecture 14

1. Do you recognize where preliminary design fits into the sequence of design "levels"? Do you go there only once?
2. Can you identify a grid from a pattern? Can you identify the grid vertically or horizontally?
3. Can you classify systems by levels, direction, and lateral resistance?
4. Can you load trace to the "collectors"?
5. Are you aware of the implication (by size) to bending stress and deflection when the length of a beam is increased?
6. Can you model the "moment" in a spanning system?
7. What is a "large" span and what members are typically used for them? Why?
8. What are some ways to limit or reduce the deflection with a long-span system?
9. Can you calculate the maximum moment from a "L/3" rule and an "L/5" rule based on optimal support locations?
10. Can you identify concentrated strategies of supports? Can you identify distributed support strategies?
11. Do you know what "degree of fit" means?
12. Do you know what "programmatic dimension" means?
13. Do you know that the soil type could influence the foundation needed and how the system selection could be influenced?
14. How do you plan grids for corners?
15. What is the effect on moment size and location and member depth needed when supports are moved from the ends on a beam span?
16. Besides beam depth, what might influence or restrict the vertical grid height?
17. How can fire safety influence the selection of the system type?