ARCH 631. Study Guide for Exam 2

This guide is not providing “answers” for the conceptual questions. It is a list of topical concepts and their application you should be familiar with. It is an aid to help prepare for the mid-term exam.

Covers material of Lectures 7, 8, 10, 11, 12, 13 & 14

General: Rigid Frames
☐ Rigid vs. non-rigid pinned frames
☐ Rigid frame behavior
☐ Connection types and load/moment transfer
☐ Moment “redistribution”
☐ Methods for analysis of statically indeterminate frames
☐ Effect of relative frame member stiffnesses
☐ Stiffness (relative to EI/L through $\Delta$, or $AE/L$ through $\delta$)
☐ Sidesway
☐ Cantilever method with lateral forces

General: Plates & Grids
☐ Plate vs. slab
☐ One-way vs. two-way behavior
☐ Aspect ratio (with respect to bay dimensions)
☐ Space frame vs. grid
☐ Unit width for design
☐ Moment redistribution
☐ Pan joists, T sections & effective width of flange
☐ Drop panels
☐ Boundary conditions & effect on deflections / moments
☐ Point loads and effect on deflections / moments
☐ Simplified Frame Analysis & “Strip” method
☐ Design shear & moments (spans “integral with support”, first interior support, etc.)
☐ Direct design method for two-way slabs & $M_o$
☐ Solutions for large shear at space frame supports
☐ Moment of inertia with respect to folded plates
☐ Reason for stiffening of folded plates
☐ Live load reduction
☐ Thickness as a fraction of bay span (L)
☐ “Punching” shear at columns

General: Membranes & Shells
☐ Appropriate loads & primary stresses
☐ Air-supported vs. air-inflated
☐ Materials, durability, and punctures
☐ Profiles and wind effects
☐ Shell vs. not shell (stresses are key)
☐ Meridional vs. Hoop
☐ Shell forces vs stresses (with respect to thickness and strips)
☐ Tension vs. compression rings
☐ “Thrust”
☐ Buckling and “snap-through”
☐ Anticlastic shell properties
☐ Pressure vs. membrane stress
☐ Curvature and membrane stress
☐ Hyperbolic paraboloid
General: Planning

- One-way vs. two-way systems
- “Collectors”
- Vertical & horizontal grid considerations
- Long span considerations
- Effect of loading types on system efficiency
- Options for corners, large spaces, etc.
- Integration with building services
- Fire safety and planning
- “Weakness” Areas (Tolerances, Lateral bracing, etc.)

Reinforced Concrete

- Cast-in place, precast, prestressed (pretensioned), post-tensioned
- Constituents to make concrete
- Slump
- Behavior in compression vs. tension of concrete
- Design methodology
- 28-day compressive strength
- Term “working stress design”
- Creep
- Camber (hogging & sagging)
- “composite”
- Transformed section
- Depth of the Whitney stress
- Moment capacity (or ultimate strength) vs. nominal moment (or strength)
- Factored design moment (or shear or ....)
- Design stress in reinforcement
- Design stress in concrete
- Reinforcement grades
- Reinforcement ratio
- Effective depth vs. depth of a beam
- Under-reinforced vs. over-reinforced
- Basis of maximum steel (related to evident strain)
- Purpose of minimum reinforcement area requirement
- Why development length is necessary
- Use of Strength Design Curves ($R_n$)
- Purpose of stirrup requirement when concrete capacity is available
- Diagonal tension cracks
- Stirrup strength
- Shrinkage
- Concrete cover and purpose
- #3 bar (meaning of the numeral)
- Purpose of compression reinforcement
- T-section behavior and stresses in flange
- One-way joists, vs. beams, vs. girders
- “Spandrel”
- One-way slab design and “unit” strip
- One-way vs. two-way slabs
- One-way vs. two-way shear (load & strength)
- Plate vs. Flat Slab
- Openings in slabs and control of openings
- Continuous beam analysis with coefficients
- Clear span / span length
- Columns with ties vs. spirals (stresses, factors, etc.)
- Interaction diagrams (P-Δ)
- Location of maximum shear in beams
- Live load reduction
- Beam self weight relationship to material density (150 lb/ft$^3$)
- Design vs. analysis