# ARCH 631. Study Guide for Exam 1

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 1, 2, 3, 4, 5, & 6**

*Statics & Mechanics*

- ☐ Vectors and scalars
- ☐ Parallelogram law
- ☐ Tip-to-tail method
- ☐ Internal vs. external forces
- ☐ Tension and compression
- ☐ Resultant of a force
- ☐ Component of a force
- ☐ Moment of a force
- ☐ Moment of a distributed load
- ☐ Moment Couple
- ☐ Equivalent Force Systems
- ☐ Concurrent vs non-concurrent force systems
- ☐ Equilibrium
- ☐ Newton's First Law
- ☐ Direction and type of force in a cable with relation to geometry
- ☐ Free Body Diagram
- ☐ Reactions at a support and relationship to motion prevented
- ☐ Statically Determinate vs. Indeterminate
- ☐ Two-force bodies and relationship to loads
- ☐ Three-force bodies
- ☐ Fixed-end moment reactions
- ☐ Pin connections
- ☐ Method of Joints
- ☐ Method of Sections
- ☐ Actions vs. reactions
- ☐ Internal shear, axial force & bending moment
- ☐ Inflection point on moment diagram
- ☐ Effect of forces on shear diagram
- ☐ Effect of moments on moment diagram
- ☐ Location of zero shear ($x$) and relation to maximum moment
- ☐ Slope relationships with integration
- ☐ Normal stress (compression & tension)
- ☐ Shear stress (non beams)
- ☐ Bearing stress
- ☐ Bending & shear stress (beams)
- ☐ Torsional (shear) stress (with respect to shape and where maximum occurs)
- ☐ Relation of strain to stress & Modulus of Elasticity
- ☐ Brittle, Ductile & Semi-brittle material behavior
- ☐ Yield strength (or point & proportional limit)
- ☐ Elastic vs. plastic range
- ☐ Ultimate strength
- ☐ Strength vs. stress
- ☐ Rupture / Fatigue behavior
- ☐ Creep
- ☐ Orthotropic vs. Isotropic vs. Anisotropic materials
- ☐ Stress concentration
- ☐ Thermal vs. elastic strains
- ☐ Geometric constraints
- ☐ Serviceability
- ☐ Buckling
- ☐ Deflections & elongation
- ☐ Stiffness (relative to EI/L through $\Delta$, or AE/L through $\delta$)
- ☐ *Superpositioning*
- ☐ Single vs. double shear

## *General: Design*

- ☐ Allowable Stress Design
- ☐ Load and Resistance Factor Design
- ☐ Factored loads
- ☐ Resistance Factors
- ☐ "Design" values vs. "Capacity"
- ☐ Factor of Safety
- ☐ Density of materials and relation to weight
- ☐ Load types (and directions) (*like D, L, S ...)*
- ☐ Minimum loads (building codes)
- ☐ Load combinations
- ☐ Serviceability and limits (ex. ponding)
- ☐ Live load reduction
- ☐ Building codes vs. standards vs. structural codes
- ☐ Stability of systems & members
- ☐ Design vs. analysis
- ☐ Efficiency
- ☐ Load tracing & (con)tributary width (vs. area)
- ☐ Static vs. dynamic loads
- ☐ Equivalent static wind load & pressure
- ☐ Concentrated loads
- ☐ Distributed loads – uniform / non-uniform
- ☐ Result of acceleration on a mass and Weight
- ☐ Period of vibration, frequency, damping & resonance

## *General: Systems*

- ☐ One-way vs. two-way systems
- ☐ Truss configurations and assumptions for analysis
- ☐ Zero-force member
- ☐ Special truss member configurations at joints and conditions
- ☐ Basis of graphical truss analysis (aka Maxwell's diagram)
- ☐ Compound truss
- ☐ "Cable" truss members
- ☐ "Shear & Moments" in parallel chord trusses
- ☐ Lenticular truss
- ☐ Vierendeel "truss"
- ☐ Catenary shape, sag
- ☐ Cable-stayed
- ☐ Pinned arches (2 vs. 3) & rigid arches
- ☐ "Thrust"
- ☐ Types and purpose of bracing
- ☐ Bearing, shear, curtain walls ...

## *General: Columns*

- ☐ Stability
- ☐ Buckling vs. crushing
- ☐ Slenderness
- ☐ Critical Buckling and Euler's Formula
- ☐ Effective length, K & bracing (end conditions)
- ☐ Beam-Columns (eccentric loading)
- ☐ Combined bending and compression – *interaction equations or diagrams*
- ☐ P-Δ effect
- ☐ Eccentricity
- ☐ Kern

## *General: Beams*

- ☐ Simply supported
- ☐ Overhang
- ☐ Cantilever
- ☐ Continuous
- ☐ w vs. W
- ☐ Equivalent center of load area
- ☐ Built-up shape
- ☐ Centroid, moment of inertia, *Q*, radius of gyration
- ☐ Neutral axis, section modulus, extreme fiber
- ☐ Negative area method
- ☐ Parallel axis theorem
- ☐ Maximum bending stress (& location along length and in cross section)

*General: Beams (Continued)*

- ☐ Maximum shear stress (& location along length and in cross section)
- ☐ Maximum shear stress by beam shape (proper equations)
- ☐ Shear flow and shear center
- ☐ Lateral buckling (and bracing)
- ☐ Torsion stresses and cross section shape
- ☐ Stress types in beams
- ☐ Self-weight
- ☐ Deflections & superpositioning (+ *units)*
- ☐ Use of Beam Diagrams and Formulas
- ☐ Principal stresses
- ☐ Efficient cross-section shapes
- ☐ Shaping a beam along the length for efficiency.
- ☐ Location of supports and efficiency.
- ☐ "Effective length" and points of inflection
- ☐ Methods for analysis of statically indeterminate beams
- ☐ Support settlements and stress redistribution
- ☐ Loading patterns for spans