ENDS 231. Study Guide for Final Examination

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 final exam.

Statics

- ☐ Sin, Cos, Tan, opposite, adjacent & hypotenuse
- ☐ Result of acceleration on a mass and Weight
- ☐ Law of transmissibility
- ☐ Internal vs. external forces
- ☐ Collinear, Coplanar, Space, Concurrent & Parallel force systems
- ☐ Equilibrium
- ☐ Resultant of a force
- ☐ Component of a force
- ☐ Moment of a force
- ☐ Direction and type of force in a cable with relation to geometry
- ☐ Free Body Diagram
- ☐ Reactions at a support and relationship to motion prevented
- ☐ Two-force bodies and relationship to loads
- ☐ Three-force bodies
- ☐ Method of Joints
- ☐ Method of Sections
- ☐ Varignon's Theorem of moments
- ☐ Equivalent Force Systems
- ☐ Moment Couple
- ☐ Statically Determinate vs. Indeterminate
- ☐ Actions vs. reactions

General: Systems

- ☐ What happened to the Wonderful "one-Hoss Shay"
- ☐ Truss configurations and assumptions for analysis
- ☐ Pinned arches and frames
- ☐ Rigid frame behavior
- ☐ Connection types and load/moment transfer
- ☐ Types and purpose of bracing
- ☐ One-way vs. two-way slab behavior
- ☐ Bearing, shear, curtain walls ...
- ☐ Framing system *choices* exist
- ☐ System selection and design should NOT be the last phase of design

Mechanics of Materials

- ☐ Normal stress (compression & tension)
- ☐ Shear stress (non beams)
- ☐ Bearing stress
- ☐ Bending & shear stress (beams)
- ☐ Torsional stress (and where is maximum)
- ☐ Relation of strain to stress & Modulus of Elasticity
- ☐ Brittle, Ductile & Semi-brittle material behavior
- ☐ Yield strength (or point & proportional limit)
- ☐ Ultimate strength
- ☐ Strength vs. stress
- ☐ Rupture / Fatigue behavior
- ☐ Isotropic, Orthotropic, Anisotropic materials
- ☐ Stress concentration
- ☐ Thermal vs. elastic strains
- ☐ Geometric constraints
- ☐ Serviceability
- ☐ Deflections & elongation
- ☐ Stiffness (relative to EI/L through Δ, or AE/L through δ)
- ☐ *Superpositioning*
- ☐ Single vs. double shear

General: Beams

- ☐ Distributed loads – uniform / non-uniform
- ☐ Simply supported
- ☐ Overhang
- ☐ Cantilever
- ☐ Continuous
- ☐ w vs. W
- ☐ Equivalent center of load area
- ☐ Load tracing & tributary width (vs. area)
- ☐ Internal shear, axial force & bending moment
- ☐ Inflection point
- ☐ Location of maximum bending with respect to size of shear
- ☐ The Equilibrium Method
- ☐ The Semigraphical Method
- ☐ Areas under a curve and *change*
- ☐ Effect of forces on shear diagram
- ☐ Effect of moments on moment diagram
- ☐ Location of zero shear (x)
- ☐ Slope relationships with integration
- ☐ Use of Beam Diagrams and Formulas
- ☐ Centroid, neutral axis, moment of inertia, section modulus, Q, radius of gyration
- ☐ Negative area method
- ☐ Parallel axis theorem
- ☐ Maximum bending stress (& location along length and in cross section)
- ☐ Maximum shear stress (& location along length and in cross section)
- ☐ Maximum shear stress by beam shape (proper equations)
- ☐ Connected area
- ☐ Nail capacity and pitch for resisting longitudinal shear
- ☐ Lateral buckling (and bracing)
- ☐ Stress types in beams
- ☐ Deflections & superpositioning (+ *units)*

General: Columns

- ☐ Stability
- ☐ Buckling
- ☐ Slenderness
- ☐ Critical Buckling and Euler's Formula
- ☐ Effective length & bracing
- ☐ Beam-columns
- ☐ Combined bending and compression - *interaction*
- ☐ P-Δ effect
- ☐ Eccentricity
- ☐ Kern

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)
- ☐ Load combinations
- ☐ Serviceability and limits
- ☐ Design vs. analysis

Timber Design

- ☐ Lumber vs. engineered timber characteristics
- ☐ Various strengths (directionality, wood type, etc.)
- ☐ Design methodology and obtaining allowed stress (like with duration factor....)
- ☐ Creep
- ☐ Column stability factor & l/d
- ☐ Connection stresses
- ☐ Nominal dimensions
- ☐ Design vs. analysis

Steel Design

- ☐ Design methodologies
- ☐ Steel grades (standard properties)
- ☐ Yield strength vs. ultimate strength
- ☐ Local buckling in web & flange
- ☐ Bearing on flange
- ☐ Plastic section modulus
- ☐ Plastic moment & plastic hinges
- ☐ Braced vs. unbraced length
- ☐ Slenderness criteria & l/r
- ☐ *with respect to least radius of gyration*
- ☐ W (first number meaning) x (second number meaning)
- ☐ Bolt designations
- ☐ Effective net area
- ☐ Area of web
- ☐ Connection types
- ☐ Weld strengths
- ☐ Throat thickness
- ☐ Fillet, butt, plug, slot
- ☐ Coping
- ☐ Tension member
- ☐ Simple shear connector
- ☐ Capacity of a connection
- ☐ Design vs. analysis