CE 325 Spring 2026
Study Guide for Exam 1

1. **Statics review** (Lectures 2-3)

    a. Calculate reactions for statically determinate beams and verify that they satisfy equilibrium.
    b. Calculate reactions and bar forces in determinate trusses and verify that they satisfy equilibrium.
    c. Draw shear and bending moment diagrams using the area/integral relationships and determine max./min. values/locations along with points of inflection.

2. **Solid mechanics review** (Lectures 4-6)

    a. Calculate the state of stress at a point in a beam subjected to bending using $\sigma = -\frac{My}{I}$ and $\tau = \frac{VQ}{Ib}$.

    This means knowing how to locate the centroid (i.e. neutral axis) of a cross section, calculating the moment of inertia I, the first moment of area Q, in addition to applying the above formulas.

    b. Determine the deflection equation(s) for a beam through integration of the differential equation $EIv'' = M(x)$ and applying appropriate boundary/compatibility/symmetry conditions.

    Calculating location and value of maximum deflection and rotation. Drawing qualitative deflected shapes based on support conditions, inflection points, etc.

3. **Matrix Displacement Method (MDM) for uniaxial structures** (Lectures 7-9)

    a. Identification of degrees of freedom (dof) in a structure with proper notation also for members, joints, forces, and reactions.
    b. Structural Level Superposition to construct system of equations: {P}= [S]{d}.
    c. Member Level Superposition to construct system of equations: {Q}= [k]{u}.
    d. Definitions of S_{ij}, and k_{ij}.
    e. Derivation of the elements of the 2x2 member stiffness matrix [k] using $\delta = \frac{PL}{EA}$
    f. Assembly of [S] from member [k] using:
        I. Rigorous Method
            1. Use of joint **equilibrium** at a dof to get P's in terms of Q's.
            2. Use of member **force displacement** relation to get Q's in terms of k's and u's.
            3. Use of **compatibility** equations to get u's in terms of d's (and zeros for supports).
            4. Simplify resulting equations to get [S] in terms of elements in member [k] matrices.
        II. Code Number Method
    g. Solution of {P} = [S]{d} to obtain {d}.
    h. For each member, use compatibility to get {u} in terms of the elements of {d}.
    i. Calculation of member end forces using {Q}= [k]{u}.
    j. Use of member end forces to obtain reactions, calculate axial stresses, and verify equilibrium and compatibility. Draw axial force diagram.