The beam experiment is designed to examine the load versus deformation responses for flexural and shear, as well as allow for comparisons between analytical and experimental moment – curvature and load – deflection relations. Based on the experimental results, your report should provide detailed information on the following items:

1. A plot of the experimentally obtained load-deflection and moment-curvature relations using readings from the load cell and displacement sensors (lvdt's) recorded during the test.
2. Based on design material strengths (i.e., $f_y = 60$ ksi and $f'_c = 4$ ksi), compute the moment – curvature diagram for the given beam cross-section. Using the moment curvature relation, compute the deflections associated with: (a) just prior to cracking, (b) just after cracking, (c) yielding, and (d) for an extreme fiber compression strain of 0.003 (Whitney Stress Block).
3. For the points in (2), as well as for strains of 0.005, 0.007, and 0.01, compute moment and curvature values and plot the relationship using a numerical, iterative approach based on material stress-strain relations, equilibrium, and plane sections assumption to obtain the numerical solution as presented in lecture. For concrete in compression, use the Hognestad equation to describe the stress – strain relation and neglect concrete in tension and neglect the influence of reinforcement on the cracking moment. Compute relations for both design and expected (or as-tested if available) material relations. Plot and compare the two relations ($M - \phi$).
4. Use the results obtained from the moment – curvature analysis to derive load versus displacement relations (design and expected material relations). For concrete strains equal to and greater than 0.003, use the “plastic hinge” concept to model the inelastic zone at the center of the beam for total plastic hinge lengths of 1.0h and 2.0h (where h is the total depth of the beam). Plot the analytical relations versus the measured relations ($P - \delta$) and comment on the results.
5. Calculate the deflection at midspan using the effective inertia as defined in ACI 318-02/05 Section 9.5.2.3. Assess the reliability of the ACI expression by comparison with the computed and measured load-displacement relations.
6. Calculate the shear strength of the beam using ACI 318-05 equations (11-3) and (11-5) for the as-tested yield stress of the stirrups (if this information is available, or design values if not). On a single plot, compare the measured and computed ($I_p = 1.0h$) load-displacement relations and the calculated shear strength (plot as a horizontal line at $P = V_n$) and discuss how the calculated shear strength is expected to influence the behavior of the tested beam based on calculated strengths versus what was actually observed.
7. Draw figures that represent the cracking distribution and widths at cracking, yielding (if appropriate), and at failure (the displacement where the load starts to decrease).

Your report should contain the necessary information needed for someone to check all your work and calculations, including: detailed material information, detailed drawings of the specimens with an adequate description of the geometry and reinforcement, example calculations (in an appendix), sensor calibration curves, and recorded data and spreadsheets used to analyze your data (via CourseWeb or CD). Your report will be checked carefully to ensure completeness.