Combined Stress

Q1. On the column show, where will the stress value be greatest?
   A1. Point A

Q2. Pre-stressing a concrete beam primarily adds what type of stress to the section?
   A2. Compression

Q3. Pre-stressed concrete members usually contain what type of reinforcement?
   A3. 7-wire steel strand with fy = 250 or 270 ksi.

Q4. Post tensioning can be used to reduce the deflection of a beam. (T/F)
   A4. T

Q5. What is the most common prestressed material?
   A5. Concrete.

Q6. In a fully prestressed concrete beam, how much of the cross sectional area can be considered effective?
   A6. The entire cross sectional area
Q7. What is the main difference between pre-tensioned and post-tensioned concrete?

A7. These terms refer to the state of the concrete during the prestressing process. Pre-tensioning occurs before the concrete cures while post tensioning occurs after the concrete has solidified.

Q8. Precast members are typically stressed using which method of tensioning?

A8. Pre-tensioning.

Q9. What type of stress is directly introduced by prestressing?

A9. Axial force

Q10. What is the main principle that supports the use of the interaction equation?

A10. The principle of superposition

Q11. What is meant by the term inverted king post? Or make a sketch of one.

A11. A “King Post Truss” is a simple triangular truss with one vertical member at the center line. In an inverted king post, the lower diagonal chords are prestressed, placing the center strut in compression against the continuous top chord.

Q12. What specific assumptions are made in regards to concrete when analyzing a prestressed member versus typical reinforced member?

A12. If a concrete member is prestressed, it is analyzed as if it were a homogeneous material with its entire section resisting the applied loads in compression and tension.
Q14. For a member to be axially loaded, where must the load be placed?

A14. At the centroid of the section

Q15. For the member shown, what are the two forces that need to be considered when calculating the combined stress?

A15. The moment Pe and the force P

Q16. If the load is placed beyond the middle 1/3 of the section, what happens?

A16. The face away from the load goes into tension

Q17. Why should a column be located in the middle 1/3 of a spread footing?

A17. To insure that the whole surface of the footing is bearing on the soil (in compression)

Q18. Rafters are commonly analyzed using the moment based on the projected length. What force is neglected by this approach?

A18. The axial force (which is relatively small)
Q19. For the system shown below, which is greater, the axial force in the cable or the beam?

A19. Cable

Q20. In the system shown above, how would lowering point A effect the load in the cable?

A20. The force in the cable would increase

Q21. In a P-\Delta analysis, where does the \Delta come from?

A21. Deflection or initial crookedness

Q22. Do post-tensioned beams have internal stress before they are subjected to live and dead loads?

A22. Yes

Q23. Where are pre-tensioned concrete beams commonly fabricated?

A23. In a factory

Q24. For a load-balanced condition, the shape of the tendon must be the same shape as which diagram?

A24. Moment

Q25. What is the effect of attaching the tendon below the neutral axis of the top beam of an inverted king-post truss?

A25. It produces a negative moment which offsets the positive moment from gravity loads.
Q26. What is the advantage of post-tension cables in the plane of a grid shell?

A26. They increase the stiffness of the shell.

Q27. In an eccentrically loaded column, when will tensile forces be developed?

A27. When \( e \) is greater than or equal to \( b/6 \).

Q28. What properly describes the combined stress introduced by the prestressing shown on the diagram below?

A28. As shown on (A), axial stresses are created by the direct force introduced by the prestressing operation.

Bending stresses produced by the eccentricity of the applied force can be described by (B).

As shown on (C), bending stress produced by the building loads is a part of combined stress.

Q29. What are the resulting loads on the column if the axial load is offset from the center axis?

A29. The resulting loads include the axial load and the moment caused by the axial load.