



1. Highly-ductile members, where $\lambda \leq \lambda_{hd}$ for all elements of the cross section, are usually acceptable for (select the most demanding acceptable bend):
 - a. Large-radius bends
 - b. Medium-radius bends
 - c. Small-radius bends
2. Which of the following is a hot-bending process?
 - a. Pyramid roll bending
 - b. Incremental step bending
 - c. Induction bending
 - d. Rotary draw bending
3. Which cross-sectional element type is most susceptible to distortion during the bending operation?
 - a. Round elements
 - b. Rectangular stiffened elements
 - c. Rectangular unstiffened elements
4. For arch end connections:
 - a. Arch action produces large horizontal reactions
 - b. Arch action produces large in-plane moments
 - c. All connections must be designed as rigid moment connections
 - d. Arch deflections must be reduced by using field welded connections
 - e. Arch stability is dependent on the connection rigidity
 - f. Both a and e
 - g. Both b and c
5. Cross-sectional distortion tolerances:
 - a. Are usually larger than mill tolerances
 - b. Should be mutually agreed upon by the contractor and the owner
 - c. Must be based on the potential effect on structural performance
 - d. Must consider aesthetic requirements for AESS members
 - e. Both c and d
 - f. a, b, c and d
6. For curved compression members, which buckling mode is the most difficult to predict due to its sensitivity to second-order effects and support spreading?
 - a. In-plane buckling
 - b. Snap-through buckling
 - c. Out-of-plane buckling
 - d. Flexural-torsional buckling



Design of Curved Members/Façade Attachments
Final Exam

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7. For horizontally-curved members in buildings, the member size is usually governed by:
 - a. Serviceability
 - b. Strength
 - c. Fatigue life

8. Typical end connections for horizontally-curved members:
 - a. Are identical to simple shear connections for an equivalent straight member
 - b. Transfer torsional loads to the support
 - c. Can be designed for either fixed or free warping boundary conditions
 - d. Connect the flanges of the curved member
 - e. Are designed as fully-rigid moment connections
 - f. b, c and d

9. The structural behavior of horizontally-curved beams is:
 - a. Dominated by flexure
 - b. Dominated by torsion
 - c. Dominated by shear
 - d. Dependent on the span angle, θ_s

10. For Example 2 of session 4, if the torsional rotation of 2.31° exceeds the serviceability limit, the rotation angle can be reduced by:
 - a. Providing warping restraint where the curved member connects to the W14x90 columns
 - b. Increasing the torsion constant, J , by replacing the curved member with a closed section such as a rectangular HSS or built-up box member
 - c. Adding additional filler beams connected to the curved beam to restrain torsion
 - d. a, b and c

11. For Example 1 of session 4, if the arch changed to a parabolic shape, the effective length factor for in-plane buckling, K_i , would be:
 - a. 0.35
 - b. 0.40
 - c. 0.50
 - d. 0.55
 - e. 0.60

12. For both vertically- and horizontally-curved members, which of the following limit state(s) can be calculated the same as for straight members?
 - a. Local buckling
 - b. Shear
 - c. Both local buckling and shear

13. Which of the following is not typically part of a built-up thermal break assembly?
 - a. Thermal isolation pads
 - b. Thermal isolation bushings
 - c. Carbon steel bolts
 - d. Thermal isolation washers



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14. True or False: The structural engineer of record and/or architect should indicate on the construction documents which elements of the facade attachments are to be adjustable in the field.
- True
 - False
15. Thermal bridges can...
- ...result in energy loss.
 - ...cause condensation within the building's envelope.
 - ...increase occupant comfort.
 - Both A & B
 - None of the above
16. Which of the following does not need to be considered in sizing joints for vertical movement?
- Live load deflections
 - Seismic drift
 - Differential settlement
 - Building self-weight deflections
17. Calculated thermal movement is a function of which of the following?
- Maximum temperature range and moisture content
 - Maximum temperature range, length between joints, and the coefficient of linear thermal expansion
 - Absolute maximum temperature, volume, and the coefficient of linear thermal expansion
 - Only the absolute maximum temperature
18. Which is not likely to create a "pinch point" condition when sizing joints for vertical movement?
- Snow load on an upper floor or roof.
 - Adjacent floors with different design live loads.
 - First elevated facade support level above a foundation wall or fixed base.
 - Self-weight of a structure with regular geometry.
19. Which of the following is not typically a panelized facade system?
- Full bed stone veneer
 - Thin stone veneer
 - Panelized brick on metal studs
 - Glass fiber-reinforced concrete
20. True or False: To calculate torsional rotations, spandrel beams that support floors or roof decks should be assumed to rotate about their centroids.
- True
 - False



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21. When designing spandrel beams, Design Guide 22 recommends which of the following?
- Calculating torsional rotations using the modified flexural analogy method for torsional spans over 30 ft long
 - Calculating torsional rotations using the modified flexural analogy method for torsional spans under 10 ft long
 - Calculating torsional rotations using the modified Design Guide 9 method for torsional spans under 10 ft long
 - Both A and C
22. Which of the following composite spandrel beam deflections cause the joints in the facade to close?
- Live load deflections
 - Rotations due to torsion
 - Concrete self-load deflections
 - Beam self-load deflections
 - Both A and B
 - A, B, C, and D
23. Which of the following statements are true?
- Accommodating building drifts at the exterior walls of the building has been a consideration since ancient times.
 - Accommodating building drifts at boundaries between different cladding systems can pose a challenge.
 - The base building engineer should dictate the façade movement strategy to the specialty engineer.
 - Because façade elements are non-structural components, the code only requires that they not pose a falling hazard at service-level loads (NOT strength-level loads).
24. True or False: Vertical movements only affect horizontal joints and horizontal movements only affect vertical joints.
- True
 - False

