

Civil Engineering Integration Reviewer

Civil Engineering · Answer Key · 26 Questions

1. What is equilibrium in structural analysis?

- A) The condition where resultant forces and moments are non-zero.
- B) The condition where the resultant force is zero but the moment can be non-zero.
- C) The condition where the resultant force and resultant moment acting on a body are zero.**
- D) The condition where the structure is in motion.

2. Why is a free-body diagram important in structural analysis?

- A) It helps to visualize the aesthetic aspects of a structure.
- B) It allows the engineer to isolate a structure or component and clearly identify all forces and reactions acting on it, forming the basis for equilibrium equations.**
- C) It is used to calculate the cost of materials.
- D) It determines the color of the structure.

3. What is the primary difference in reactions provided by a pin support compared to a roller support in a 2D system?

- A) A pin provides only vertical reactions, while a roller provides horizontal and vertical reactions.
- B) A pin provides horizontal and vertical reactions, while a roller provides one reaction perpendicular to the supporting surface.**
- C) Both provide horizontal and vertical reactions.
- D) A pin provides a moment reaction, while a roller does not.

4. What is the formula for calculating the moment (M) of a force (F) at a perpendicular distance (d)?

- A) $M = F + d$
- B) $M = F / d$
- C) $M = F * d$**
- D) $M = F - d$

5. Which of the following is an example of a dead load?

- A) People in a building
- B) Furniture in an office
- C) Walls and roofing of a structure**
- D) Movable equipment.

6. What is the primary function of a load path in a structural system?

- A) To determine the aesthetic appearance of the structure.
- B) To transfer applied loads safely through the structural system to the foundation and soil.**
- C) To calculate the wind speed acting on the structure.
- D) To measure the temperature of the building materials.

7. What are the four major internal forces that can act on a structural member?

- A) Axial force, shear force, bending moment, and torsion.**
- B) Tension, compression, shear, and bending.
- C) Horizontal force, vertical force, moment, and torsion.
- D) Axial force, lateral force, torsional moment, and shear.

8. What is the difference between tension and compression?

- A) Tension pulls members apart, while compression pushes them together.**
- B) Tension shortens members, while compression elongates them.
- C) Tension causes bending, while compression causes twisting.
- D) Tension and compression are the same thing.

9. How is shear force typically resisted in reinforced concrete beams?

- A) Solely by the concrete.
- B) Through the combined contribution of concrete and transverse reinforcement like stirrups.**
- C) Only by the main longitudinal reinforcement.
- D) By the foundation alone.

10. What causes bending stress in a structural member?

- A) Twisting about the longitudinal axis.
- B) Forces acting parallel to the cross-section.
- C) Loads or moments that produce curvature.**
- D) Forces acting along the longitudinal axis.

11. What is torsion in a structural member?

- A) A force acting along the longitudinal axis.
- B) A force tending to cause adjacent portions to slide.
- C) Twisting caused by a moment acting about the longitudinal axis.**
- D) Bending of the member.

12. What is the formula for stress (?) if force (P) is applied over an area (A)?

- A) $\sigma = A / P$
- B) $\sigma = P * A$
- C) $\sigma = P / A$**
- D) $\sigma = P + A$

13. What is strain (ϵ) defined as, where ΔL is the change in length and L is the original length?

- A) $\epsilon = L / \Delta L$
- B) $\epsilon = \Delta L * L$
- C) $\epsilon = L - \Delta L$
- D) $\epsilon = \Delta L / L$**

14. What does Young's modulus (E) represent in Hooke's Law ($\sigma = E\epsilon$)?

- A) The ultimate strength of the material.
- B) The stiffness of the material in the elastic range.**
- C) The total deformation of the material.
- D) The applied force.

15. What is the key difference between elastic and plastic behavior of a material?

- A) Elastic behavior allows permanent deformation, while plastic behavior allows the material to return to its original shape.
- B) Elastic behavior allows the material to return to its original shape after unloading (within the elastic limit), while plastic behavior involves permanent deformation.**
- C) Elastic behavior is always stronger than plastic behavior.
- D) There is no difference between elastic and plastic behavior.

16. Where is bending stress zero in an idealized beam theory relationship?

- A) At the extreme top fibers.
- B) At the extreme bottom fibers.
- C) At the neutral axis.**
- D) At the supports.

17. Why is moment of inertia important in structural design?

- A) It determines the color of the beams.
- B) It affects bending stress, deflection, and structural stiffness.**
- C) It is only important for aesthetic purposes.
- D) It calculates the weight of the structure.

18. What is serviceability in structural design?

- A) Ensuring the structure can withstand extreme loads without collapsing.
- B) Ensuring the structure performs acceptably under normal conditions without excessive deflection, cracking, vibration, or other performance problems.**
- C) Ensuring the structure is aesthetically pleasing.
- D) Ensuring the structure can be built quickly.

19. Why is reinforcement placed in concrete?

- A) To increase the compressive strength of concrete.
- B) To provide tensile resistance and improve the structural capacity and behavior of concrete members, as concrete is weak in tension.**
- C) To make the concrete more workable.
- D) To reduce the cost of the structure.

20. What is the primary reason for reducing excess water in concrete mix design?

- A) To make the concrete set faster.
- B) To increase workability and ease of placement.
- C) To reduce strength and durability and increase permeability and shrinkage.**
- D) To make the concrete lighter.

21. What does workability describe in fresh concrete?

- A) How easily it can be mixed, placed, consolidated, and finished without segregation or excessive bleeding.**
- B) How quickly it hardens.
- C) How strong it becomes after curing.
- D) How much water it can absorb.

22. What is the purpose of a slump test?

- A) To measure the compressive strength of concrete.
- B) To determine the water-cement ratio.
- C) To indicate the consistency/workability of fresh concrete.**
- D) To check the durability of hardened concrete.

23. What is the main benefit of curing concrete?

- A) To speed up the hydration process and allow cement hydration to continue, helping concrete develop its intended strength and durability.**
- B) To make the concrete waterproof.
- C) To increase the initial setting time.
- D) To reduce the amount of cement needed.

24. In a singly reinforced beam, where is the primary flexural reinforcement mainly placed?

- A) In the compression zone.
- B) In the tension zone.**
- C) Around the neutral axis.
- D) In the middle of the beam's depth.

25. Why might a doubly reinforced beam be used?

- A) When additional flexural capacity is required or beam dimensions are restricted.**
- B) To reduce the amount of concrete needed.
- C) To increase the weight of the beam.
- D) When there is no bending moment.

26. Which type of reinforced concrete section is generally preferred for ductile behavior, and why?

- A) Over-reinforced, because it fails suddenly.
- B) Under-reinforced, because the yielding of tension reinforcement provides significant deformation before ultimate failure, giving a more ductile failure mode.**
- C) An equally reinforced section.
- D) Neither, as they are equally safe.