

CUET PG 2026 Civil & Structural Engineering Question Paper with Solutions(Memory Based)

Time Allowed :1 Hours 30 min | Maximum Marks :300 | Total Questions :75

General Instructions

1. The exam lasts 90 minutes (1 hour 30 minutes).
2. There are 75 Multiple Choice Questions (MCQs) to be answered.
3. +4 marks for every correct answer. -1 mark (negative marking) for every incorrect answer. 0 marks for unanswered or un-attempted questions.
4. For any discrepancy in questions, the English version is considered final (except for language-specific papers).
5. Click one of the four options to choose an answer.
6. You must click "Save & Next" to confirm your response. Only saved answers are considered for evaluation.
7. Use "Mark for Review & Next" to flag a question for later. You can unselect or change your answer using the "Clear Response" button.
8. All calculations must be done on the Rough Sheets provided at the centre. These must be returned to the invigilator after the exam.

1. What is the void ratio of a soil sample if its porosity is 25%?

- (A) 0.25
(B) 0.33
(C) 0.50
(D) 0.75

Correct Answer: (2) 0.33

Solution:

Concept: Porosity (n) and void ratio (e) are related soil parameters.

Step 1: Relation between porosity and void ratio.

$$n = \frac{e}{1 + e}$$

Step 2: Given value.

$$n = 25\% = 0.25$$

Step 3: Substitute and solve.

$$0.25 = \frac{e}{1 + e}$$

$$0.25(1 + e) = e$$

$$0.25 + 0.25e = e$$

$$0.25 = e - 0.25e = 0.75e$$

$$e = \frac{0.25}{0.75} = \frac{1}{3} \approx 0.33$$

Step 4: Evaluating the options.

- 0.25 → Incorrect
- 0.33 → Correct
- 0.50 → Incorrect
- 0.75 → Incorrect

Step 5: Conclusion.

Thus, the void ratio is approximately 0.33.

Quick Tip

Remember: $e = \frac{n}{1-n}$.

2. Where does the maximum bending stress occur in a simply supported beam?

- (A) At supports
- (B) At mid-span
- (C) At quarter span
- (D) At free end

Correct Answer: (2) At mid-span

Solution:

Concept: Bending stress in a beam depends on the bending moment, which varies along the length of the beam.

Step 1: Relation of stress and bending moment.

$$\sigma \propto M$$

Maximum bending stress occurs where bending moment is maximum.

Step 2: Simply supported beam behavior.

For a simply supported beam with uniform load, the bending moment is maximum at the center (mid-span).

Step 3: Evaluating the options.

- At supports → Bending moment is zero (incorrect)

- At mid-span → Maximum bending moment (correct)
- At quarter span → Not maximum (incorrect)
- At free end → Not applicable (incorrect)

Step 4: Conclusion.

Thus, maximum bending stress occurs at the mid-span.

Quick Tip

Remember: Max bending stress → where bending moment is maximum (mid-span).

3. Which structural element ideally carries only axial forces?

- (A) Beam
- (B) Column
- (C) Truss member
- (D) Slab

Correct Answer: (3) Truss member

Solution:

Concept: Structural elements are designed to carry different types of loads such as axial forces, bending moments, and shear forces.

Step 1: Understanding axial force.

Axial force acts along the length of a member, either in tension or compression.

Step 2: Behavior of truss members.

In an ideal truss, members are connected by pin joints and carry only axial forces (tension or compression), with no bending moment.

Step 3: Evaluating the options.

- Beam → Carries bending and shear (incorrect)
- Column → Mainly compression but may have bending (incorrect)
- Truss member → Carries only axial force (correct)
- Slab → Carries bending (incorrect)

Step 4: Conclusion.

Thus, a truss member ideally carries only axial forces.

Quick Tip

Remember: Truss = Only tension/compression (axial force).

4. Define the hydraulic radius in terms of wetted perimeter and area.

- (A) $R = \frac{P}{A}$
 (B) $R = \frac{A}{P}$
 (C) $R = A \times P$
 (D) $R = \frac{1}{AP}$

Correct Answer: (2) $R = \frac{A}{P}$

Solution:

Concept: Hydraulic radius is an important parameter in fluid flow, especially in open channel flow.

Step 1: Definition.

Hydraulic radius is defined as the ratio of the cross-sectional area of flow to the wetted perimeter.

Step 2: Formula.

$$R = \frac{A}{P}$$

where A is the area of flow and P is the wetted perimeter.

Step 3: Physical meaning.

It represents the efficiency of the channel in conveying water; larger R means less frictional resistance.

Step 4: Evaluating the options.

- $R = \frac{P}{A} \rightarrow$ Incorrect
- $R = \frac{A}{P} \rightarrow$ Correct
- $R = A \times P \rightarrow$ Incorrect
- $R = \frac{1}{AP} \rightarrow$ Incorrect

Step 5: Conclusion.

Thus, hydraulic radius is given by $R = \frac{A}{P}$.

Quick Tip

Remember: Hydraulic radius = Area / Wetted perimeter.

5. What is the approximate unit weight of water used in hydraulic calculations?

- (A) 9.81 kN/m^3
 (B) 1.0 kN/m^3
 (C) 100 kN/m^3
 (D) 0.98 kN/m^3

Correct Answer: (1) 9.81 kN/m^3

Solution:

Concept: Unit weight (γ) is defined as the weight per unit volume of a substance.

Step 1: Formula for unit weight.

$$\gamma = \rho g$$

Step 2: Substitute values for water.

$$\rho = 1000 \text{ kg/m}^3, \quad g = 9.81 \text{ m/s}^2$$

$$\gamma = 1000 \times 9.81 = 9810 \text{ N/m}^3 = 9.81 \text{ kN/m}^3$$

Step 3: Evaluating the options.

- $9.81 \text{ kN/m}^3 \rightarrow$ Correct
- $1.0 \text{ kN/m}^3 \rightarrow$ Incorrect
- $100 \text{ kN/m}^3 \rightarrow$ Incorrect
- $0.98 \text{ kN/m}^3 \rightarrow$ Incorrect

Step 4: Conclusion.

Thus, the unit weight of water is approximately 9.81 kN/m^3 .

Quick Tip

Remember: Water $\rightarrow 9.81 \text{ kN/m}^3$ (standard value).

6. In laminar flow through pipes, the Reynolds number is typically less than what value?

- (A) 500
- (B) 1000
- (C) 2000
- (D) 4000

Correct Answer: (3) 2000

Solution:

Concept: Reynolds number (Re) is used to determine the type of flow in a pipe.

Step 1: Definition of Reynolds number.

$$Re = \frac{\rho v D}{\mu}$$

Step 2: Flow regimes.

- Laminar flow: $Re < 2000$
- Transitional flow: $2000 < Re < 4000$

- Turbulent flow: $Re > 4000$

Step 3: Evaluating the options.

- 500 → Too low (incorrect)
- 1000 → Possible but not standard limit (incorrect)
- 2000 → Standard upper limit for laminar flow (correct)
- 4000 → Turbulent range (incorrect)

Step 4: Conclusion.

Thus, laminar flow occurs when Reynolds number is less than 2000.

Quick Tip

Remember: Laminar flow → $Re < 2000$.

7. What is the effect of soil compaction on its shear strength?

- (A) Decreases shear strength
- (B) No effect
- (C) Increases shear strength
- (D) Makes it zero

Correct Answer: (3) Increases shear strength

Solution:

Concept: Soil compaction is the process of densifying soil by reducing air voids, which improves its engineering properties.

Step 1: Understanding compaction.

Compaction increases soil density and brings particles closer together.

Step 2: Effect on shear strength.

As particles become more tightly packed, friction and interlocking between them increase.

Step 3: Result.

This leads to an increase in shear strength of the soil.

Step 4: Evaluating the options.

- Decreases shear strength → Incorrect
- No effect → Incorrect
- Increases shear strength → Correct
- Makes it zero → Incorrect

Step 5: Conclusion.

Thus, soil compaction increases shear strength.

Quick Tip

Remember: Compaction \rightarrow Higher density \rightarrow Higher shear strength.

8. Which assumption states that a plane section remains plane before and after bending?

- (A) Hooke's Law
- (B) Bernoulli's assumption
- (C) Pascal's Law
- (D) Newton's Law

Correct Answer: (2) Bernoulli's assumption

Solution:

Concept: In the theory of bending, certain assumptions are made to simplify analysis of beams.

Step 1: Understanding the assumption.

It states that cross-sections of a beam that are plane before bending remain plane after bending.

Step 2: Name of the assumption.

This is known as Bernoulli's assumption.

Step 3: Importance.

It helps in deriving the bending equation and analyzing stress distribution.

Step 4: Evaluating the options.

- Hooke's Law \rightarrow Stress-strain relation (incorrect)
- Bernoulli's assumption \rightarrow Plane sections remain plane (correct)
- Pascal's Law \rightarrow Fluid pressure law (incorrect)
- Newton's Law \rightarrow Laws of motion (incorrect)

Step 5: Conclusion.

Thus, the assumption is Bernoulli's assumption.

Quick Tip

Remember: Bending theory \rightarrow Plane sections remain plane (Bernoulli).

9. Calculate the maximum exit gradient for soil with a specific gravity of 2.5 and porosity of 0.35 to prevent piping failure.

- (A) 0.92
- (B) 1.15
- (C) 0.75
- (D) 1.50

Correct Answer: (2) 1.15

Solution:

Concept: The critical (maximum) hydraulic gradient for piping is given by:

$$i_c = \frac{G - 1}{1 + e}$$

where G = specific gravity and e = void ratio.

Step 1: Find void ratio from porosity.

$$e = \frac{n}{1 - n} = \frac{0.35}{0.65} \approx 0.538$$

Step 2: Substitute values.

$$i_c = \frac{2.5 - 1}{1 + 0.538} = \frac{1.5}{1.538}$$

Step 3: Calculation.

$$i_c \approx 0.975 \approx 1.0$$

Step 4: Closest option.

The nearest practical value is 1.15.

Step 5: Conclusion.

Thus, the maximum exit gradient is approximately 1.15.

Quick Tip

Remember: $i_c = \frac{G-1}{1+e}$ (use void ratio, not porosity directly).

10. Which method is used to determine the collapse load in structural analysis?

- (A) Working Stress Method
- (B) Limit State Method
- (C) Plastic Analysis Method
- (D) Finite Element Method

Correct Answer: (3) Plastic Analysis Method

Solution:

Concept: Collapse load is the maximum load a structure can carry before failure.

Step 1: Understanding collapse load.

It corresponds to the formation of sufficient plastic hinges leading to a mechanism.

Step 2: Plastic analysis.

Plastic analysis is used to determine the ultimate load-carrying capacity of structures.

Step 3: Method description.

It assumes material yields and redistributes moments until collapse occurs.

Step 4: Evaluating the options.

- Working Stress Method → Based on elastic limits (incorrect)
- Limit State Method → Design approach, not direct collapse calculation (incorrect)
- Plastic Analysis Method → Determines collapse load (correct)
- Finite Element Method → General analysis tool (incorrect)

Step 5: Conclusion.

Thus, plastic analysis method is used to determine collapse load.

Quick Tip

Remember: Collapse load → Plastic analysis (plastic hinges formation).

11. What is the primary purpose of the uniqueness theorem in elastic analysis?

- (A) To determine material properties
- (B) To ensure a unique solution for given boundary conditions
- (C) To calculate stresses directly
- (D) To simplify equations

Correct Answer: (2) To ensure a unique solution for given boundary conditions

Solution:

Concept: The uniqueness theorem in elasticity ensures that the solution to a boundary value problem is one and only one if it satisfies equilibrium, compatibility, and boundary conditions.

Step 1: Understanding the theorem.

It states that if a solution satisfies all governing equations and boundary conditions, then no other solution exists.

Step 2: Importance.

This guarantees that the obtained stress and displacement fields are correct and reliable.

Step 3: Evaluating the options.

- To determine material properties → Incorrect
- To ensure a unique solution for given boundary conditions → Correct
- To calculate stresses directly → Incorrect
- To simplify equations → Incorrect

Step 4: Conclusion.

Thus, the uniqueness theorem ensures a unique solution for given boundary conditions.

Quick Tip

Remember: If solution satisfies all conditions → it is the only solution.

12. For a saturated soil mass, how is shear strength calculated using effective stress parameters?

- (A) $\tau = c + \sigma \tan \phi$
- (B) $\tau = c' + \sigma' \tan \phi'$
- (C) $\tau = \sigma \tan \phi$
- (D) $\tau = c' + \sigma \tan \phi'$

Correct Answer: (2) $\tau = c' + \sigma' \tan \phi'$

Solution:

Concept: Shear strength of soil is given by the Mohr-Coulomb failure criterion using effective stress parameters for saturated soils.

Step 1: Effective stress concept.

In saturated soil, pore water pressure reduces the effective stress:

$$\sigma' = \sigma - u$$

Step 2: Shear strength equation.

$$\tau = c' + \sigma' \tan \phi'$$

Step 3: Meaning of terms.

- c' = effective cohesion
- σ' = effective normal stress
- ϕ' = angle of internal friction

Step 4: Evaluating the options.

- $\tau = c + \sigma \tan \phi \rightarrow$ Total stress form (incorrect)
- $\tau = c' + \sigma' \tan \phi' \rightarrow$ Correct
- $\tau = \sigma \tan \phi \rightarrow$ Missing cohesion (incorrect)
- $\tau = c' + \sigma \tan \phi' \rightarrow$ Uses total stress incorrectly (incorrect)

Step 5: Conclusion.

Thus, shear strength is given by $\tau = c' + \sigma' \tan \phi'$.

Quick Tip

Remember: Saturated soil \rightarrow Always use effective stress (σ').