

AP TRANSCO, GENCO Civil Memory Based Paper 23 Aug 2026

Q.1 According to IS 456:2000, how is the nominal shear stress (τ_v) in a beam calculated? Where, V_u = Factored shear force b = Breadth of beam d = Effective depth of the beam section D = Overall depth of section

- A. $\tau_v = V_u / (b + D)$
- B. $\tau_v = V_u / d$
- C. $\tau_v = V_u / (b \times d)$
- D. $\tau_v = V_u / b$

Answer: C

Sol: According to **IS 456:2000**, the **nominal shear stress (τ_v)** in a reinforced concrete beam is calculated as:

$$\tau_v = \frac{V_u}{bd}$$

where:

V_u = Factored shear force

- b = Breadth (width) of the beam
- d = Effective depth of the beam section

The nominal shear stress represents the average shear stress acting on the cross-section of the beam and is used to check the shear strength of concrete and to design shear reinforcement.

Hence, the correct answer is:

C) $\tau_v = V_u / (b \times d)$

Q.2 To calculate the compressive strength of compression member, Imperfection factor considered for Buckling 'class d' is .

- A. 0.21
- B. 0.49
- C. 0.34
- D. 0.76

Answer: D

Sol: Solution

As per IS 800:2007, the compressive strength of a compression member is determined considering the effect of initial imperfections through the imperfection factor α .

The imperfection factors corresponding to different buckling classes are:

Buckling Class Imperfection Factor α

a 0.21



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Buckling Class Imperfection Factor α

- b 0.34
- c 0.49
- d 0.76

For buckling class d,

$\alpha=0.76$

Therefore, the correct answer is:

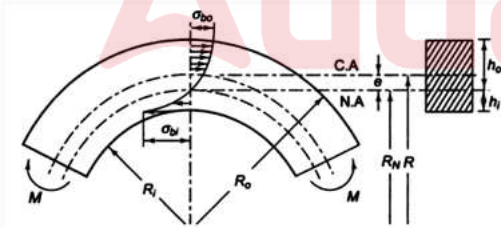
Option D — 0.76

Q.3 The bending stress in a curved beam varies such that it is

- A. Zero at the neutral axis
- B. Zero at the point other than centroidal axis
- C. Maximum at the neutral axis
- D. None of these

Answer: A

Sol: The bending stress in case of curved beam, varies hyperbolically with the distance from the neutral axis and variation is not linear as in case of straight beams. In symmetrical cross-sections (circular, rectangular etc.), maximum bending stress always occurs at the inner fiber.



Q.4 The maximum bending moment in a simply supported beam subjected to point load at mid point occurs:

- A. Supports
- B. Mid span
- C. Quarter span
- D. Under point load

Answer: B

Sol: The maximum bending moment in a simply supported beam of length L subjected to a point load 'W' occurs at mid span of beam and the magnitude of maximum bending moment will be $\frac{WL}{4}$.

Q.5 Euler's critical buckling load for a column fixed at one end and free at other end is:

- A. $\frac{\pi^2 EI}{L^2}$
- B. $\frac{\pi^2 EI}{2L^2}$
- C. $\frac{\pi^2 EI}{4L^2}$
- D. $\frac{4\pi^2 EI}{L^2}$

Answer: C

Sol: Euler's critical buckling load for a column depends on its end conditions and the material properties.

For a column fixed at one end and free at the other end, the formula for the critical buckling load P_{cr} is given by:

$$P_{cr} = \frac{\pi^2 EI}{L^2}$$

Where:

P_{cr} is the critical buckling load,

E is the modulus of elasticity of the material,

I is the moment of inertia of the column's cross-section,

L is the effective length of the column.

For a column fixed at one end and free at the other end, the effective length factor is 2. So, the formula for the critical buckling load

$$P_{cr} = \frac{\pi^2 EI}{(2L)^2}$$

This simplifies to:

$$P_{cr} = \frac{\pi^2 EI}{4L^2}$$

Q.6 As per IS 8112 : 2013, If the final setting time of ordinary Portland cement-grade 43 is greater than _____, such cement should be rejected

- A. 10 hours
- B. 4 hours
- C. 8 hours
- D. 6 hours

Answer: A

Sol: As per IS 8112:2013, the final setting time of Ordinary Portland Cement Grade 43 shall not be more than 600 minutes.

$$600 \text{ minutes} = 10 \text{ hours}$$

Therefore, if the final setting time is greater than 10 hours, the cement should be rejected.

Hence, the specified maximum final setting time is:

$$\text{Final setting time} = 10 \text{ hours}$$

Correct Answer: A — 10 hours

Q.7 The heaviest I-section for the same depth In IS classification of Rolled steel Beams will be:

- A. ISHB
- B. ISLB
- C. ISWB
- D. ISMB

Answer: A

Sol: Solution

In the IS classification of rolled steel beams, the different I-sections are classified according to their shape, depth and weight per metre.

The commonly used rolled steel beam sections are:

ISLB — Indian Standard Light Weight Beam

ISMB — Indian Standard Medium Weight Beam

ISWB — Indian Standard Wide Flange Beam

ISHB — Indian Standard Heavy Weight Beam

For a given nominal depth, the ISHB section has the greatest weight per metre and hence is the heaviest I-section.

Therefore,

ISHB=Heaviest I-section for the same depth

Hence, the correct answer is:

Option A — ISHB

Q.8 Piezometer is suitable for fluid related measurements which are_____.

- A. Small and positive
- B. Small and negative
- C. Large and positive
- D. Large and negative
- E. None of these

Answer: A

Sol: Piezometer is used to measured moderate positive gauge pressure of liquid.

Q.9 Poissons ratio and bulk modulus of a material are defined in which of the following stress states, respectively

- A. Uniaxial and uniaxial
- B. Uniaxial and triaxial
- C. Tiraxial and triaxial
- D. Triaxial and uniaxial

Answer: B

Sol: Correct option: B — Uniaxial and Triaxial

• **Poisson's ratio (ν or ν_u)** is defined under **uniaxial stress**, where a material is subjected to stress in one direction. It is the ratio of **lateral strain to longitudinal strain**.

• $\nu = - \text{Lateral strain} / \text{Longitudinal strain}$

Bulk modulus (K) is defined under **triaxial (hydrostatic) stress**, where equal normal stresses act in all three mutually perpendicular directions. It is the ratio of **hydrostatic pressure to volumetric strain**.

- K = Hydrostatic stress / Volumetric strain

Thus:

- **Poisson's ratio** → **Uniaxial stress state**
- **Bulk modulus** → **Triaxial (hydrostatic) stress state**

Answer: B — Uniaxial and Triaxial

Q.10 A rectangular tank of 20 m^2 area filled with water to a height of 5 m, calculate the total water pressure (F) at the bottom of the tank.

- A. 981000 Newtons
- B. 98100 Newtons
- C. 9810000 Newtons
- D. 9810 Newtons

Answer: A

Sol: Given:

$$A = 20 \text{ m}^2$$

$$h = 5 \text{ m}$$

$$\rho = 1000 \text{ kg/m}^3$$

$$g = 9.81 \text{ m/s}^2$$

Pressure at the bottom of the tank is:

$$p = \rho gh$$

$$p = 1000 \times 9.81 \times 5$$

$$p = 49050 \text{ N/m}^2$$

Total force acting on the bottom is:

$$F = pA$$

$$F = \rho ghA$$

$$F = 1000 \times 9.81 \times 5 \times 20$$

$$F = 981000 \text{ N}$$

Therefore, the total water pressure force at the bottom of the tank is 981000N.

Correct Answer: A — 981000 Newtons

Q.11 According to the basic considerations of Working Stress method for reinforced concrete design, the stress-strain relationship of steel and concrete under working loads is taken as:

- A. Quadratic
- B. Parabolic
- C. Linear
- D. Logarithmic

Answer: C

Sol: Correct Answer: C) Linear

Detailed Explanation

The **Working Stress Method (WSM)**, also known as the **Elastic Method**, is based on the assumption that both **concrete and steel behave elastically under working loads**.

$\sigma \propto \epsilon$
 $\sigma = E\epsilon$
 $\sigma = \text{Stress}$
 $\epsilon = \text{Strain}$
 $E = \text{Modulus of Elasticity}$

Therefore, the stress-strain relationship for both materials is assumed to be **linear** within the permissible stress limits

- Q.12** In a bolted connection, the ratio of net tensile area at root of threads to nominal plain shank area of a bolt may be taken as per IS 1367 (Part-1) or in the absence of provision of table
- A. 0.88
 - B. 0.87
 - C. 0.68
 - D. 0.78

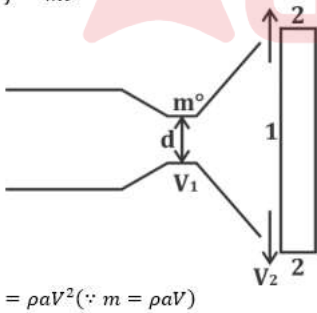
Answer: D

Sol:
 A_{nb} = Net tensile area at the root of threads
 A_b = Nominal plain shank area of bolt
 $\frac{A_{nb}}{A_b} = 0.78$
 $A_{nb} = 0.78A_b$
Therefore, the correct answer = 0.78

- Q.13** The force exerted by a jet of water on a stationary vertical plate in the direction of the jet is _____.
Where, ρ = Mass density of the liquid, a = cross sectional area of the jet, V = Velocity of the jet.
- A. ρaV^3
 - B. ρa^2V
 - C. ρaV^2
 - D. ρaV
 - E. None of these

Answer: C

Sol: Then the horizontal force can be calculated as
 $f = mv$



- Q.14** Efficient transfer of stress between matrix and fibers in fiber reinforced concrete does not depend upon ____.
- A. Intensity of applied load
 - B. Type of fiber
 - C. Size and shape of the aggregates
 - D. Fiber geometry

Answer: A

Sol: In fiber-reinforced concrete, stress is transferred from the concrete matrix to the fibers through the fiber-matrix interface. The efficiency of this stress transfer depends mainly on the properties and geometry of the fibers and the matrix. The important factors include:

- Type of fiber
- Fiber geometry
- Bond between fiber and matrix
- Properties of the concrete matrix

The intensity of the applied load does not determine the basic efficiency of stress transfer between the matrix and fibers. It represents the magnitude of loading applied to the composite rather than a fundamental material parameter controlling the transfer mechanism. Therefore, efficient transfer of stress between matrix and fibers does not depend upon the intensity of applied load. Hence, the correct answer is A.
Correct Answer: A — Intensity of applied load

Q.15 The vane shear test on a soil sample to determine its shear strength can be performed ____.

- A. only in laboratory
- B. both in field and laboratory
- C. only on field
- D. neither on field nor in laboratory as it is an empirical method of shear strength estimation

Answer: B

Sol: The vane shear test is mainly used for soft to medium stiff clays and can be conducted: In-situ (field) to measure the undrained shear strength of undisturbed soil, and In the laboratory on remoulded samples to determine the sensitivity of the clay.

$$\text{Undrained Shear Strength (Vane Shear Test)} \tau = \frac{T}{\pi D^2 \left(\frac{H}{2} \right) + \frac{\pi D^3}{6}}$$

$$\text{Sensitivity of Clay } S_t = \frac{\text{Undisturbed strength}}{\text{Remoulded strength}}$$

Q.16 The ductility factor considered for common structural steel exhibiting minimum specified ductility, while calculating effective net area in case of design of tension members will be .

- A. 2
- B. 0
- C. 1
- D. 3

Answer: C

Sol: δ = Ductility factor

For common structural steels having minimum specified ductility,

$$\delta = 1$$

Therefore, the ductility factor considered is

$$\delta = 1$$

Correct answer = 1

Q.17 A soil sample weighs 120 g and after oven drying the weight reduces to 90 g. What will be the weight of water before oven drying?

- A. 30 g
- B. 210 g
- C. 90 g
- D. 120 g

Answer: A

Sol: Wet weight = 120g

Dry weight = 90g

Weight of water = $120 - 90 = 30\text{g}$

Moisture content (w) = $\frac{30}{90} \times 100\% = 33.33\%$

Q.18 Which of the following statements is correct when the marine deposits are under a very large depth of water?

- A. It has low effective stress and high shear strength
- B. It has low effective stress and low shear strength
- C. It has effective stress and low shear strength
- D. It has high effective stress and high shear strength

Answer: B

Sol: Sol.

- Marine deposits that are subjected to high water depth experience an increase in hydrostatic pressure.
- Increase in pressure reduces the effective stress within the deposits.
- Effective stress is the portion of total stress that contributes to the shear strength and deformation of soil.
- Higher water pressure reduces effective stress, leading to lower shear strength in the marine deposits.

Q.19 For the design of the steel members. Which of the following is NOT a correct combination of load as per IS 800:2007?

- A. Dead load + imposed load + wind + earthquake load
- B. Dead load + wind or earthquake load
- C. Dead load + erection load
- D. Dead load + imposed load

Answer: A

Sol: Sol. Acc. To IS 800:2007.

- wind load and earthquake loads shall not be assumed to act simultaneously.
- The following combination of loads with appropriate partial safety factors may be considered.
- (a) Dead load + imposed load.
- (b) Dead load + imposed load + wind load or earthquake load.
- (c) Dead load + wind or earthquake load.
- (d) Dead load + erection load.

Q.20 All the following are the assumptions made in Terzaghi's theory of consolidation EXCEPT:

- A. The coefficient of permeability of soil varies at all points during the entire period of consolidation
- B. The soil is fully saturated
- C. The soil is homogeneous and isotropic
- D. Darcy's law is valid throughout the consolidation process

Answer: A

Sol: Sol.

- The following were the assumptions made in Terzaghi's theory of consolidation.
- The soil is fully saturated
- The soil is homogeneous and isotropic
- Darcy's law is valid
- The coefficient of permeability is constant.
- So, the option (a) is wrong.
- The boundary is free surface.
- Soil particle and water are incompressible

Q.21 The discharge equation for a triangular V-notch with coefficient of discharge 0.6 is given by _____.
where, Q = discharge through triangular V notch and H = Head of water above V notch.

- A. $Q = 1.417H^{3/2}$
- B. $Q = 1.417H^{2/3}$
- C. $Q = 1.417H^{5/2}$
- D. $Q = 1.417H^{1/2}$

Answer: C

Sol: For a triangular V-notch, the discharge equation is:

$$Q = (8/15) C_d \sqrt{2g} \tan(\theta/2) H^{5/2}$$

For the given coefficient of discharge:

$$C_d = 0.6$$

For a standard 90° V-notch:

$$\theta = 90^\circ$$

Therefore,

$$Q = (8/15) \times 0.6 \times \sqrt{2 \times 9.81} \times \tan(45^\circ) \times H^{5/2}$$

$$Q \approx 1.417H^{5/2}$$

Q.22 The bearing capacity of soil supporting an isolated footing of size 3 m x 3m will be affected by the presence of a water table located at a depth of below the base of the footing,

- A. 3.5m
- B. 40m
- C. 1.5m
- D. 55m

Answer: C

Sol: As per Terzaghi's theory, if the water table is available at a depth greater than or equal to least lateral dimension of footing than no correction is applied. In the given option only 1.5 m is less than or equal to the least lateral dimension of footing.

Q.23 When a fluid is at rest, rate of increase of pressure in a vertical direction is equal to the weight density at that point is called as:

- A. Hydro Dynamic Law
- B. Pressure Dynamic Law
- C. Hydro Static Law
- D. Pressure Static Law

Answer: C

Sol: Solution:

When a fluid is at rest, it is said to be in hydrostatic equilibrium.

For a fluid at rest, pressure varies with depth due to the weight of the fluid.

$$\frac{dp}{dz} = -\rho g$$

where,

p = Pressure

z = Vertical elevation

ρ = Density of fluid

g = Acceleration due to gravity

When depth is measured downward,

$$\frac{dp}{dh} = \rho g$$

The term ρg represents the weight density or specific weight of the fluid.

Thus, the rate of increase of pressure in the vertical direction is equal to the weight density of the fluid.

This principle is known as Hydrostatic Law.

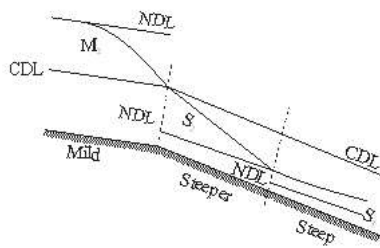
Correct Answer: C

Q.24 The bed slope of gradually varied flow in an open channel change from mild to steeper and steeper to steep. The type of GVF profile generated is

- A. M_1, S_3, S_2
- B. M_2, S_2, S_3
- C. M_2, S_3, S_2
- D. M_1, S_2, S_3
- E. None of these

Answer: B

Sol:



Q.25 The minimum water content at which the soil just begins to crumble when rolled into threads 3 mm in diameter, is known as:

- A. Yield limit
- B. Liquid limit
- C. Shrinkage limit
- D. Plastic limit

Answer: D

Sol: The plastic limit is defined as the lowest moisture content at which soil can be rolled into 3 mm diameter threads without crumbling. Below this water content, the soil becomes brittle and breaks apart.

Information Booster

Plastic limit is used in determining the plasticity index,

$$P_L = L_L - P_L$$

Tests are widely used in soil classification (Atterberg limits).

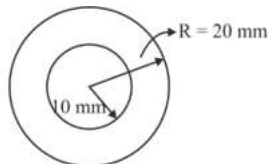
Plastic limit reflects the transition from plastic to semi-solid state.

Q.26 A hollow circular section having outer radius 20 mm and inner radius 10 mm. Calculate the section modulus of that section

- A. $\frac{3750}{\pi}$
- B. 3750π
- C. 1875π
- D. $\frac{1725}{\pi}$

Answer: C

Sol:



$$R = 20 \text{ mm}$$

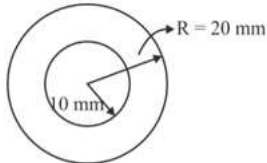
$$r = 10 \text{ mm}$$

$$\text{Section modulus of hollow section } (Z) = \frac{I_{NA}}{y_{\max}}$$

$$I_{NA} = \frac{\pi(R^4 - r^4)}{4} = \frac{\pi \times (20^4 - 10^4)}{4} = 37500\pi \text{ mm}^4$$

$$y_{\max} = R = 20 \text{ mm}$$

$$Z = \frac{I_{NA}}{R} = \frac{37500\pi}{20} = 1875\pi$$



Q.27 The intensity of loading at the base or the foundation which would cause shear failure of the soil support is called as:

- A. Ultimate bearing capacity
- B. Allowable bearing capacity
- C. Safe bearing capacity
- D. Net soil pressure

Answer: A

Sol: The ultimate bearing capacity is the maximum pressure that can be applied at the foundation level which will cause the shear failure of the supporting soil. It represents the extreme limit of loading before the soil fails structurally.

Additional Knowledge

Allowable bearing capacity: Ultimate bearing capacity divided by a factor of safety.

Safe bearing capacity: Net ultimate capacity divided by factor of safety.

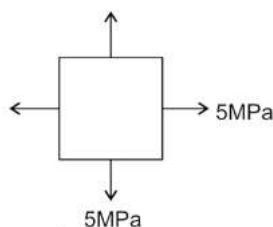
Net soil pressure: Gross bearing pressure minus overburden pressure at foundation level.

Q.28 A stress element is subjected to tensile stress of 5 MPa on both the principal planes. The radius of Mohr Circle corresponding to this element will be

- A. 10 MPa
- B. 7.5 MPa
- C. 5 MPa
- D. Zero

Answer: D

Sol:



$$\sigma_x = 5 \text{ MPa}$$

$$\sigma_y = 5 \text{ MPa}$$

$$\text{Radius of Mohr's circle} = \left| \frac{\sigma_x - \sigma_y}{2} \right|$$

$$= \left| \frac{5 - 5}{2} \right| = 0$$

Q.29 If the unconfined compressive strength of a saturated clay is 360 kPa , then its estimated shear strength (kPa) would be:

- A. 180
- B. 120
- C. 240
- D. 360

Answer: A

Sol: $s_u = \frac{q_u}{2}$
 $q_u = 360 \text{ kPa}$
 $s_u = \frac{360}{2} = 180 \text{ kPa}$

Q.30 What is the ratio of maximum shear stress to average shear stress in a solid square section?

- A. 1.5
- B. 4
- C. 1.33
- D. 2

Answer: A

Sol: Correct Answer: A. 1.5

Explanation

For a **solid rectangular section**, the maximum shear stress is:

$$\tau_{\max} = \frac{3}{2} \tau_{\text{avg}}$$

where:

- V = shear force
- A = cross-sectional area

For a rectangular (and hence square) section, the shear stress distribution is parabolic, with:

- Zero stress at the top and bottom fibers.
- Maximum stress at the neutral axis.

The maximum shear stress is:

$$\tau_{\max} = \frac{3V}{2A}$$

$$\frac{\tau_{\max}}{\tau_{\text{avg}}} = \frac{\frac{3V}{2A}}{\frac{V}{A}} = \frac{3}{2} = 1.5$$

Q.31 If a plane truss satisfies the condition $m = 2J - 3$ where m is members, J is no of joint then it is

- A. Determinate internally
- B. Determinate externally
- C. Indeterminate internally
- D. Indeterminate externally

Answer: A

Sol:



Q.32 Steady state of flow refers to:

- A. Flow changes with time
- B. Depth of flow in a channel will remain same
- C. Flow does not change with time
- D. Depth of flow in a channel will vary
- E. None of these

Answer: C

Sol: Types of flow :

- i) **Steady flow** : The flow in which flow condition like velocity, pressure does not changes with time is known as steady flow.
- ii) **Unsteady flow** : The flow in which flow condition like velocity, pressure can changes with time is known as unsteady flow.
- iii) **Uniform flow** : The type of flow in which the velocity at any given time does not changes with respect to space.
- iv) **Non-uniform flow** : The type of flow in which the velocity at any given time changes with respect to space.
- v) **Laminar flow** : The type of flow in which fluid particle move along well defined path or stream line and all stream lines are straight and parallel.

Q.33 According to IS 456:2000, under what conditions can the shear strength of an RC section near the supports or concentrated load be enhanced?

- A. When the considered beam section is farther from the face of a support or concentrated load than twice the effective depth ($2d$)
- B. When the considered beam section is closer to the face of a support or concentrated load than twice the effective depth ($2d$) of the beam
- C. Enhancement is not permitted near the supports
- D. When the considered beam section is exactly at a distance equal to the effective depth (d) from the support

Answer: B

Sol: Correct Answer: B. When the considered beam section is closer to the face of a support or concentrated load than twice the effective depth ($2d$) of the beam

Explanation:

According to **IS 456:2000 (Clause 40.5)**, the shear strength of a reinforced concrete beam section may be enhanced when the section under consideration lies **within a distance of $2d$ from the face of a support or concentrated load**, where d is the effective depth of the beam.

Near supports and concentrated loads, the distribution of stresses is different from that assumed in ordinary beam theory. The load is transferred directly to the support through a compressive strut action, which increases the beam's resistance to shear failure. Therefore, the code permits an enhancement in the design shear strength for such sections.

The enhancement factor depends on the distance of the section from the face of the support or concentrated load and is applied subject to the provisions specified in IS 456:2000.

A. When the considered beam section is farther from the face of a support or concentrated load than twice the effective depth ($2d$)

This is incorrect because the code permits enhancement only for sections located within a distance of **$2d$** from the support or concentrated load.

C. Enhancement is not permitted near the supports

This is incorrect. IS 456:2000 specifically allows enhancement of shear strength near supports and concentrated loads under prescribed conditions.

D. When the considered beam section is exactly at a distance equal to the effective depth (d) from the support

This is incorrect because the provision applies to all sections located within **2d** of the support or concentrated load, not only at a distance equal to **d**.

Conclusion:

As per **IS 456:2000**, enhancement of shear strength is permitted when the section considered is located **closer than 2d from the face of a support or concentrated load**.

Answer: B. When the considered beam section is closer to the face of a support or concentrated load than twice the effective depth (2d) of the beam.

Q.34 According to IS-2062 for E 165 (Fe 290) grade of steel, the minimum elongation percentage is .

- A. 45
- B. 72
- C. 23
- D. 30

Answer: C

Sol: Solution:

As per IS 2062, the mechanical properties of E 165 (Fe 290) grade steel are:

Yield stress = 165MPa

Tensile strength = 290MPa

Minimum elongation = 23%

Therefore, the minimum elongation percentage is:

23%

Hence, the correct answer is Option C.

Q.35 In R.C.C. cantilever retaining wall, if the check for overturning is not satisfied, which of the following would serve the better in meeting the check?

- A. increasing the heel slab span
- B. decreasing the toe slab span
- C. providing a sloping backfill
- D. providing a shear key

Answer: A

Sol: Correct Option: A (Increasing the heel slab span)

Solution

In an **R.C.C. cantilever retaining wall**, stability against overturning is provided by the **restoring moment**, which is mainly due to:

- Self-weight of the wall.
- Weight of the soil resting on the heel slab.

The overturning moment is caused by the lateral earth pressure acting on the stem.

If the **overturning check is not satisfied**, the restoring moment must be increased.

Among the given options:

- **Increasing the heel slab span** increases the area of soil resting on the heel slab. This increases the weight of the retained soil and consequently the restoring moment, making the wall more stable against overturning.
- **Decreasing the toe slab span** reduces the base width and generally decreases stability.
- **Providing a sloping backfill** does not improve overturning stability; in fact, it usually increases the active earth pressure.

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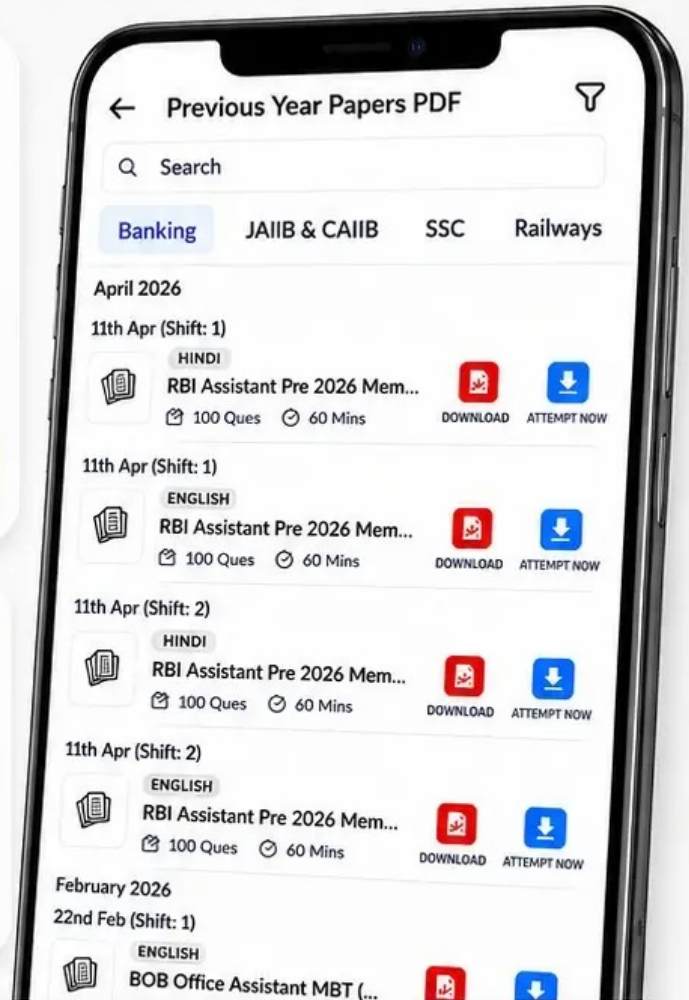
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- **Providing a shear key** improves resistance against sliding but has little effect on overturning.

Therefore, increasing the **heel slab span** is the most effective measure to satisfy the overturning criterion.

Hence, the correct answer is **Option A (Increasing the heel slab span)**.

