

Civil Engineering

1. The property of a building material to resist wear and abrasion is known as:

- A) Hardness
- B) Toughness
- C) Strength
- D) Durability

Answer: A) Hardness

Explanation: Hardness is the ability of a material to resist scratching, indentation, and surface wear. It is an important property for materials used in flooring and pavements.

2. A series of connected lines of known length and direction that are used to establish control points in surveying is called a:

- A) Baseline
- B) Check line
- C) Traverse
- D) Tie line

Answer: C) Traverse

Explanation: A traverse can be open (starting and ending at different points) or closed (starting and ending at the same point or another known point), and it forms the primary framework for a survey.

3. The shear strength of a cohesionless soil (like sand) is primarily dependent on:

- A) Its cohesion value
- B) The angle of internal friction
- C) The unconfined compressive strength
- D) Its plasticity index

Answer: B) The angle of internal friction

Explanation: For cohesionless soils, the shear strength is given by Coulomb's law as $\tau = \sigma \tan(\phi)$, where σ is the normal stress and ϕ is the angle of internal friction. Cohesion (c) is zero.

4. The ratio of the inertia force to the viscous force in a fluid flow is represented by the:

- A) Reynolds Number
- B) Froude Number

C) Mach Number

D) Weber Number

Answer: A) Reynolds Number

Explanation: The Reynolds number ($Re = \rho v L / \mu$) is a crucial dimensionless quantity used to predict the flow regime (laminar or turbulent) in pipes and channels.

5. The point of zero shear force in a beam corresponds to the point of:

A) Maximum Bending Moment

B) Zero Bending Moment

C) Maximum Deflection

D) Zero Deflection

Answer: A) Maximum Bending Moment

Explanation: The shear force (V) is the derivative of the bending moment (M) with respect to the beam's length (x), i.e., $V = dM/dx$. Where V is zero, the slope of the bending moment diagram is zero, indicating a local maximum or minimum.

6. The minimum percentage of longitudinal reinforcement in an RCC column, based on the gross cross-sectional area, is:

A) 0.4%

B) 0.8%

C) 1.0%

D) 4.0%

Answer: B) 0.8%

Explanation: As per IS 456:2000, this minimum reinforcement is required to prevent failure due to bending moments and to reduce the effects of creep and shrinkage. The maximum is typically 6%.

7. The main function of fish plates in a railway track is to:

A) Hold the rails to the sleepers

B) Maintain the correct gauge

C) Join two rails together in an end-to-end connection

D) Provide a path for drainage

Answer: C) Join two rails together in an end-to-end connection

Explanation: Fish plates are bolted to the web of two adjacent rails to maintain their continuity and alignment, both horizontally and vertically, at the rail joint.

8. The process of treating water to reduce its hardness, primarily by removing calcium and magnesium ions, is called:

- A) Aeration
- B) Water softening
- C) Coagulation
- D) Filtration

Answer: B) Water softening

Explanation: Hardness causes soap scum and scale formation in pipes and boilers. Common softening methods include the lime-soda process and ion exchange.

9. The time-cost optimization technique in construction management that involves crashing activities to reduce project duration is primarily associated with:

- A) PERT
- B) CPM
- C) Gantt Chart
- D) Milestone Chart

Answer: B) CPM (Critical Path Method)

Explanation: CPM is a deterministic model where activity durations are known. It allows for the analysis of trade-offs between the cost of a project and its completion time (crashing).

10. A land is considered to be waterlogged if its:

- A) Soil is completely saturated
- B) Water table is very deep
- C) Soil pores in the root zone are saturated, cutting off air circulation
- D) Crop yield is very high

Answer: C) Soil pores in the root zone are saturated, cutting off air circulation

Explanation: Waterlogging deprives plant roots of essential oxygen, leading to poor growth and reduced crop yields. It is often caused by over-irrigation and poor drainage.

11. The slump test for concrete is a measure of its:

- A) Strength
- B) Durability
- C) Consistency or Workability
- D) Unit weight

Answer: C) Consistency or Workability

Explanation: The slump test measures the consistency of fresh concrete before it sets. It indicates the "wetness" of the mix and is a simple, effective on-site test for workability.

12. The imaginary line passing through the points of zero declination on the Earth's surface is known as the:

- A) Isogonic line
- B) Agonic line
- C) Magnetic meridian
- D) True meridian

Answer: B) Agonic line

Explanation: Declination is the angle between the true north and the magnetic north. An isogonic line connects points of equal declination, while an agonic line is the specific line of zero declination.

13. The most effective method for compacting sandy soils in the field is:

- A) Rolling with smooth-wheeled rollers
- B) Tamping with rammers
- C) Vibration
- D) Kneading action of sheep foot rollers

Answer: C) Vibration

Explanation: Vibratory compactors are highly effective for cohesionless soils like sand and gravel, as the vibrations reduce the inter-particle friction, allowing the grains to settle into a denser configuration.

14. The pressure at a point in a static fluid is equal in all directions. This principle is known as:

- A) Archimedes' Principle
- B) Bernoulli's Principle
- C) Pascal's Law
- D) Newton's Law of Viscosity

Answer: C) Pascal's Law

Explanation: Pascal's law is a fundamental principle of fluid statics and is the basis for hydraulic systems like hydraulic jacks and presses.

15. The ratio of the effective length of a column to its least radius of gyration is called the:

- A) Slenderness Ratio

- B) Aspect Ratio
- C) Poisson's Ratio
- D) Shape Factor

Answer: A) Slenderness Ratio

Explanation: The slenderness ratio is a critical parameter in column design, as it determines the column's tendency to fail by buckling rather than by direct compression (crushing).

16. In the design of steel structures, a gusset plate is used to:

- A) Increase the cross-section of a member
- B) Connect multiple structural members meeting at a joint
- C) Prevent lateral buckling of a beam
- D) Provide a bearing surface for a column

Answer: B) Connect multiple structural members meeting at a joint

Explanation: Gusset plates are essential components in steel trusses and frames, allowing the forces from various members (like diagonals and chords) to be transferred effectively at a connection point.

17. The desirable rate of change of superelevation on a highway curve to prevent discomfort to passengers is known as:

- A) Camber
- B) Gradient
- C) Rate of introduction of superelevation
- D) Shift

Answer: C) Rate of introduction of superelevation

Explanation: The superelevation is introduced gradually over the length of the transition curve to smoothly counteract the centrifugal force as a vehicle enters the circular curve.

18. The "blue baby" disease (methemoglobinemia) in infants can be caused by the presence of excess amounts of which of the following in drinking water?

- A) Chlorides
- B) Sulfates
- C) Fluorides
- D) Nitrates

Answer: D) Nitrates

Explanation: When ingested, nitrates can be converted to nitrites, which interfere with the oxygen-carrying capacity of the blood, a condition particularly dangerous for infants.

19. The amount deducted from a contractor's bill to be held by the client as a security against defective work is called:

- A) Earnest Money
- B) Security Deposit
- C) Retention Money
- D) Mobilization Advance

Answer: C) Retention Money

Explanation: Retention money is released to the contractor after the successful completion of the defects liability period, ensuring that the contractor rectifies any issues that may arise after construction.

20. The type of cement that is most suitable for use in massive concrete structures like dams, due to its low heat of hydration, is:

- A) Ordinary Portland Cement (OPC)
- B) Rapid Hardening Cement
- C) Low Heat Portland Cement
- D) Portland Pozzolana Cement

Answer: C) Low Heat Portland Cement

Explanation: By reducing the rate of heat generation, this cement minimizes thermal cracking in large concrete pours, which can compromise the structure's integrity.

21. The value of a property at the end of its design life, when it is to be dismantled and the materials sold, is known as:

- A) Salvage Value
- B) Book Value
- C) Market Value
- D) Scrap Value

Answer: D) Scrap Value

Explanation: Scrap value represents the value of the constituent materials of an asset. It can be positive or negative (if the cost of demolition exceeds the sale price of materials).

22. A satellite's orbit that is synchronized with the Earth's rotation, making it appear stationary from the ground, is a:

- A) Polar Orbit
- B) Geostationary Orbit
- C) Sun-synchronous Orbit
- D) Low Earth Orbit

Answer: B) Geostationary Orbit

Explanation: Geostationary orbits are crucial for communication and weather satellites, as they allow an antenna on the ground to be pointed permanently at the satellite without tracking.

23. A brick laid with its length parallel to the face of the wall is called a:

- A) Header
- B) Stretcher
- C) Closer
- D) Bat

Answer: B) Stretcher

Explanation: The longer face of the brick visible in the elevation is the stretcher face. A course of bricks laid in this manner is a stretcher course.

24. The sudden failure of a material subjected to repeated cycles of loading and unloading at a stress level much lower than its ultimate tensile strength is known as:

- A) Creep
- B) Fatigue
- C) Rupture
- D) Buckling

Answer: B) Fatigue

Explanation: Fatigue failure is a progressive and localized structural damage that occurs when a material is subjected to cyclic loading. It is a critical consideration in the design of bridges and machinery.

25. The hydraulic jump is a phenomenon that occurs in open channel flow when the flow changes from:

- A) Laminar to Turbulent
- B) Subcritical to Supercritical
- C) Supercritical to Subcritical
- D) Steady to Unsteady

Answer: C) Supercritical to Subcritical

Explanation: A hydraulic jump is characterized by a sudden rise in water depth, significant turbulence, and a large loss of energy. It is often used as an energy dissipator downstream of spillways.

26. The bearing capacity of a soil can be improved by:

- A) Increasing its water content
- B) Compacting the soil to a higher density
- C) Removing the surcharge load
- D) Increasing the void ratio

Answer: B) Compacting the soil to a higher density

Explanation: Compaction increases the shear strength and stiffness of the soil by reducing the air voids, thereby increasing its ability to support loads without failure or excessive settlement.

27. The process of finding the position of a survey station by sighting on three known points is known as the:

- A) Two-point problem
- B) Three-point problem
- C) Traversing
- D) Trilateration

Answer: B) Three-point problem

Explanation: The three-point problem is a method of resection used in plane table surveying to locate the instrument's position on the map when its position is unknown.

28. The aggregate that passes through a 4.75 mm IS sieve is classified as:

- A) Coarse Aggregate
- B) Fine Aggregate
- C) All-in Aggregate
- D) Cyclopean Aggregate

Answer: B) Fine Aggregate

Explanation: According to Indian Standards, fine aggregate (sand) consists of particles that pass through the 4.75 mm sieve, while coarse aggregate is retained on it.

29. A structure that facilitates the passage of a canal over a natural drain or river, with the canal bed level being higher than the drain's high flood level, is a/an:

- A) Aqueduct

- B) Superpassage
- C) Syphon aqueduct
- D) Level crossing

Answer: A) Aqueduct

Explanation: An aqueduct is essentially a water bridge, allowing the canal water to flow freely under gravity across the drainage channel below it.

30. The activity in a project network that has the longest duration is always:

- A) On the critical path
- B) A dummy activity
- C) Not necessarily on the critical path
- D) The last activity of the project

Answer: C) Not necessarily on the critical path

Explanation: The critical path is determined by the sequence of activities that gives the longest total duration, not by any single activity's duration. A short activity can be on the critical path if it has no float.

31. A temporary platform constructed for workers and materials during the construction or repair of a building is:

- A) Shoring
- B) Scaffolding
- C) Underpinning
- D) Gantry

Answer: B) Scaffolding

Explanation: Scaffolding provides a safe working platform at various heights and can be made from timber, steel, or aluminum components.

32. The modulus of elasticity of M25 grade concrete, as per IS 456:2000, can be estimated as:

- A) 20,000 MPa
- B) 25,000 MPa
- C) 30,000 MPa
- D) 36,000 MPa

Answer: B) 25,000 MPa

Explanation: The short-term modulus of elasticity of concrete (E_c) is given by the empirical formula $E_c = 5000 \sqrt{f_{ck}}$, where f_{ck} is the characteristic compressive strength. For M25, $E_c = 5000 \sqrt{25} = 25,000$ MPa.

33. The pressure exerted by the soil on a retaining wall is known as:

- A) Active earth pressure
- B) Passive earth pressure
- C) Earth pressure at rest
- D) Surcharge

Answer: A) Active earth pressure

Explanation: This pressure occurs when the wall moves away from the soil backfill, allowing the soil to expand and mobilize its shear strength. It is the minimum pressure exerted by the soil.

34. A device used to measure the rate of flow of a fluid through a pipe is a:

- A) Piezometer
- B) Manometer
- C) Venturimeter
- D) Pitot tube

Answer: C) Venturimeter

Explanation: A venturimeter works on Bernoulli's principle by measuring the pressure difference between the full-bore section and a constricted throat section to calculate the flow rate.

35. The steel reinforcement bars that are bent up near the supports of a beam are primarily designed to resist:

- A) Bending moment
- B) Shear force
- C) Torsion
- D) Axial compression

Answer: B) Shear force

Explanation: Bent-up bars, along with vertical stirrups, are effective in resisting diagonal tension (shear) which is typically maximum near the supports of a simply supported beam.

36. The type of railway gradient on which the maximum load that a locomotive can haul is determined is the:

- A) Ruling Gradient

- B) Pusher Gradient
- C) Momentum Gradient
- D) Gradient at Stations

Answer: A) Ruling Gradient

Explanation: The ruling gradient is the steepest gradient found in a particular section of the track, and it dictates the maximum weight of the train that can operate on that section.

37. A runway numbering, such as '09', indicates that the runway is oriented approximately:

- A) 9 degrees from true north
- B) 90 degrees from true north (East)
- C) 9 degrees from magnetic north
- D) 90 degrees from magnetic north (East)

Answer: D) 90 degrees from magnetic north (East)

Explanation: Runway numbers are one-tenth of the magnetic azimuth of the runway's direction. '09' corresponds to 090 degrees (East), and the opposite end would be '27' (270 degrees, West).

38. The sludge produced from a water treatment plant using alum as a coagulant is:

- A) Highly organic and biodegradable
- B) Rich in nutrients like nitrogen and phosphorus
- C) A non-hazardous chemical sludge, primarily aluminum hydroxide
- D) Black and has an offensive odor

Answer: C) A non-hazardous chemical sludge, primarily aluminum hydroxide

Explanation: Alum (aluminum sulfate) sludge is a gelatinous, inorganic precipitate that can be challenging to dewater. Its disposal is a significant operational aspect of water treatment plants.

39. The systematic process of acquiring goods, services, or works from an outside external source is known as:

- A) Tendering
- B) Estimation
- C) Procurement
- D) Valuation

Answer: C) Procurement

Explanation: Procurement is a broad term that encompasses the entire process from identifying the need for a product or service to its acquisition and payment, including tendering and contract management.

40. The volume of a 50 kg bag of cement is approximately:

- A) 0.035 cubic meters
- B) 0.050 cubic meters
- C) 0.065 cubic meters
- D) 0.100 cubic meters

Answer: A) 0.035 cubic meters

Explanation: This volume is derived from the bulk density of cement, which is typically around 1440 kg/m³. So, Volume = Mass / Density = 50 / 1440 ≈ 0.0347 m³. This is a standard value used in mix design calculations.

41. The moment of inertia of a circular section of diameter 'd' about its diametral axis is:

- A) $\frac{\pi d^4}{64}$
- B) $\frac{\pi d^4}{32}$
- C) $\frac{\pi d^3}{32}$
- D) $\frac{\pi d^2}{4}$

Answer: A) $\frac{\pi d^4}{64}$

Explanation: This is a fundamental formula in mechanics of materials, used in the calculation of bending and torsional stresses in circular shafts and beams. The polar moment of inertia is $\frac{\pi d^4}{32}$.

42. The process of turning the telescope of a theodolite in the vertical plane by 180 degrees about the trunnion axis is called:

- A) Swinging
- B) Transiting or Plunging
- C) Centering
- D) Levelling

Answer: B) Transiting or Plunging

Explanation: Transiting is done to eliminate certain instrumental errors by taking readings on both faces (face left and face right) of the theodolite.

43. A structure carrying a road or railway over a valley or a river, typically consisting of a series of arches or spans, is a:

- A) Causeway
- B) Viaduct

C) Culvert

D) Subway

Answer: B) Viaduct

Explanation: A viaduct is similar to a bridge but is used to cross a long stretch of low ground, a valley, or a series of obstacles, often with multiple, similar spans.

44. The force that resists the sliding of one layer of fluid over another is known as:

A) Pressure

B) Viscosity

C) Surface Tension

D) Buoyancy

Answer: B) Viscosity

Explanation: Viscosity is a measure of a fluid's internal friction. Highly viscous fluids (like honey) resist motion, while low-viscosity fluids (like water) flow easily.

45. The web of a steel I-beam is primarily designed to resist:

A) Bending moment

B) Shear force

C) Axial tension

D) Torsion

Answer: B) Shear force

Explanation: In an I-beam, the flanges are most effective at resisting the bending moment (compressive and tensile forces), while the web is primarily responsible for carrying the shear stresses.

46. The type of irrigation where water is applied directly to the root zone of individual plants through a network of pipes and emitters is:

A) Flood Irrigation

B) Furrow Irrigation

C) Sprinkler Irrigation

D) Drip Irrigation

Answer: D) Drip Irrigation

Explanation: Drip or trickle irrigation is the most water-efficient method, as it minimizes losses due to evaporation and runoff by delivering water slowly and precisely where it is needed.

47. In airport design, the area where aircraft are parked for loading, unloading, refueling, and maintenance is the:

- A) Runway
- B) Taxiway
- C) Apron
- D) Terminal Building

Answer: C) Apron

Explanation: The apron, also known as the ramp, is the area adjacent to the terminal building or hangars. It is a critical interface between the airside and landside operations of an airport.

48. The biochemical reaction in which complex organic compounds are broken down into simpler substances in the absence of oxygen is called:

- A) Aerobic decomposition
- B) Anaerobic decomposition
- C) Photosynthesis
- D) Oxidation

Answer: B) Anaerobic decomposition

Explanation: This process, also known as digestion or fermentation, is used in wastewater treatment (e.g., in septic tanks and sludge digesters) and results in the production of biogas (methane and carbon dioxide).

49. An estimate of cost prepared based on the plinth area of a building and a known plinth area rate is a:

- A) Detailed estimate
- B) Revised estimate
- C) Preliminary or approximate estimate
- D) Supplementary estimate

Answer: C) Preliminary or approximate estimate

Explanation: This type of estimate is prepared in the early stages of a project to determine its approximate cost for administrative approval and feasibility studies, before detailed drawings are ready.

50. The type of rock formed by the cooling and solidification of molten magma or lava is:

- A) Sedimentary rock
- B) Metamorphic rock

C) Igneous rock

D) Calcareous rock

Answer: C) Igneous rock

Explanation: Examples of igneous rocks used as building materials include granite (formed below the surface) and basalt (formed from volcanic lava). They are typically hard, strong, and durable.

51. The elastic property of a material to regain its original shape and size after the removal of an external load is called:

A) Plasticity

B) Elasticity

C) Ductility

D) Malleability

Answer: B) Elasticity

Explanation: Within the elastic limit, deformation is temporary and proportional to the applied load (Hooke's Law). Beyond this limit, permanent (plastic) deformation occurs.

52. The process of determining the difference in elevation between two points by using a level and a staff is:

A) Differential levelling

B) Profile levelling

C) Reciprocal levelling

D) Trigonometric levelling

Answer: A) Differential levelling

Explanation: This is the most common method of levelling, involving a series of backsights and foresights to carry a level from a point of known elevation (benchmark) to other points.

53. For a retaining wall, the pressure exerted by the soil when the wall is pushed towards the backfill is the:

A) Active earth pressure

B) Passive earth pressure

C) Earth pressure at rest

D) Pore water pressure

Answer: B) Passive earth pressure

Explanation: This is the maximum possible lateral pressure that the soil can exert. It requires significant wall movement to mobilize and acts as a resisting force.

54. The theoretical time taken for a small particle to settle from the surface to the bottom of a sedimentation tank is known as the:

- A) Detention period
- B) Overflow rate
- C) Surface loading rate
- D) Settling velocity

Answer: A) Detention period

Explanation: The detention period is the average time a water particle stays in the tank, calculated as $\text{Tank Volume} / \text{Flow Rate}$. For efficient settling, the detention period should be greater than the settling time of the target particles.

55. In steel design, the sections that can develop plastic hinges and have the rotation capacity required for the failure of the structure by the formation of a plastic mechanism are called:

- A) Plastic sections
- B) Compact sections
- C) Semi-compact sections
- D) Slender sections

Answer: A) Plastic sections

Explanation: Plastic sections (Class 1) are the most efficient for plastic design, as they can redistribute moments fully, allowing the structure to achieve its maximum load-carrying capacity.

56. The extra width of pavement provided on the horizontal curves of a road is called:

- A) Superelevation
- B) Camber
- C) Extra widening
- D) Transition curve

Answer: C) Extra widening

Explanation: Extra widening is necessary to account for the mechanical off-tracking of vehicles and the psychological tendency of drivers to stay further from the edge of the pavement on curves.

57. The legal document that grants ownership of a piece of property is a:

- A) Lease
- B) Mortgage
- C) Deed

D) Contract

Answer: C) Deed

Explanation: A title deed is the legal instrument used to transfer the title (ownership) of real property from one person or entity to another.

58. The process of removing gases, such as carbon dioxide and hydrogen sulfide, dissolved in water is known as:

A) Aeration

B) Sedimentation

C) Disinfection

D) Softening

Answer: A) Aeration

Explanation: Aeration involves bringing water and air into close contact to remove dissolved gases (which cause odor and taste problems) and to oxidize dissolved metals like iron and manganese.

59. A painting defect characterized by a wrinkled appearance of the paint film is:

A) Blistering

B) Flaking

C) Wrinkling

D) Chalking

Answer: C) Wrinkling

Explanation: Wrinkling occurs when the top layer of paint dries faster than the underlying layer, often caused by applying the paint too thickly or painting in very hot weather.

60. The component of a building that transmits the load from the structure to the underlying soil or rock is the:

A) Beam

B) Column

C) Slab

D) Foundation

Answer: D) Foundation

Explanation: The foundation is the lowest part of the structure. Its primary function is to safely distribute the building's load over a large enough area of soil to prevent shear failure or excessive settlement.