Civil Engineering

1. The admixture used to improve the workability of concrete without significantly affecting the strength is a:

A) Retarder

B) Accelerator

C) Plasticizer (Water Reducer)

D) Air-entraining agent

Answer: C) Plasticizer (Water Reducer)

Explanation: Plasticizers are organic or inorganic compounds that, when added to concrete, disperse the cement particles. This action reduces the amount of water needed for a given consistency, thereby improving workability or allowing for a reduction in the water-cement ratio to increase strength.

2. A window that projects outward from the main walls of a building is known as a:

A) Casement window

B) Bay window

C) Skylight window

D) Clerestory window

Answer: B) Bay window

Explanation: A bay window is a window space projecting outward from the main walls of a building and forming a bay in a room, either square or polygonal in plan.

3. The process of locating the position of a plane table station with reference to two already plotted points is called:

A) Resection

B) Intersection

C) Two-point problem

D) Traversing

Answer: C) Two-point problem

Explanation: The two-point problem is a method of resection where the position of the instrument station is determined by sighting towards two well-defined points whose positions have already been plotted on the map.

4. The property of a soil that allows it to undergo large deformations without cracking or crumbling is:

A) Elasticity

B) Plasticity

C) Permeability

D) Brittleness

Answer: B) Plasticity

Explanation: Plasticity is a key characteristic of cohesive soils (clays). It is the ability of the soil to be molded into different shapes when moist and to retain that shape upon drying. The plasticity index (PI) quantifies this property.

5. The force that opposes the motion of a body when it slides or tends to slide over another body is:

A) Viscosity

B) Friction

C) Buoyancy

D) Inertia

Answer: B) Friction

Explanation: Friction is a contact force that arises due to the microscopic interactions between two surfaces. It always acts in the direction opposite to the relative motion or impending motion.

6. The point through which the resultant of all gravitational forces on a body acts, regardless of its orientation, is the:

A) Center of pressure

B) Metacenter

C) Center of gravity

D) Centroid

Answer: C) Center of gravity

Explanation: The center of gravity is the average location of the weight of an object. For a uniform body, it coincides with the centroid, which is the geometric center.

7. The stress induced in a body due to a change in temperature when its expansion or contraction is restrained is called:

A) Bending stress

B) Shear stress

C) Thermal stress

D) Hoop stress

Answer: C) Thermal stress

Explanation: Thermal stress develops because the material is not free to change its dimensions as the temperature changes. It is calculated as $\sigma = E \alpha \Delta T$, where E is Young's modulus, α is the coefficient of thermal expansion, and ΔT is the change in temperature.

8. The hydraulic structure designed to dissipate the surplus energy of water flowing from a spillway or sluice is a/an:

A) Stilling basin

B) Fish ladder

C) Divide wall

D) Head regulator

Answer: A) Stilling basin

Explanation: A stilling basin, often located at the downstream end of a dam or weir, uses features like chute blocks and end sills to force a hydraulic jump, which is highly turbulent and effective at dissipating the destructive kinetic energy of the high-velocity flow.

9. The process of converting raw sludge from wastewater treatment into a more stable, less odorous material with reduced volume is:

A) Sludge thickening

B) Sludge dewatering

C) Sludge digestion

D) Sludge incineration

Answer: C) Sludge digestion

Explanation: Sludge digestion, which can be aerobic or anaerobic, uses microorganisms to break down the complex organic matter in the sludge, reducing its volume and pathogen content and, in the case of anaerobic digestion, producing biogas.

10. The main purpose of providing a transition curve on a highway is to:

A) Gradually introduce the superelevation and counteract the centrifugal force

B) Increase the sight distance on the curve

C) Widen the pavement on the curve

D) Reduce the gradient of the road

Answer: A) Gradually introduce the superelevation and counteract the centrifugal force

Explanation: A transition curve (e.g., a spiral) provides a gradual change in radius from infinity (on the straight) to the radius of the circular curve, allowing for a smooth and safe transition for the driver.

11. A sleeper in a railway track that is made from a combination of two concrete blocks and a steel tie bar is a:

A) Wooden sleeper

B) Steel sleeper

C) Cast iron sleeper

D) Two-block concrete sleeper

Answer: D) Two-block concrete sleeper

Explanation: This type of sleeper is lighter than a full monoblock concrete sleeper and is sometimes used on secondary lines. The steel tie bar is responsible for maintaining the correct gauge.

12. The method of project management that is event-oriented and probabilistic is:

A) Critical Path Method (CPM)

B) Program Evaluation and Review Technique (PERT)

C) Bar Chart

D) Milestone Chart

Answer: B) Program Evaluation and Review Technique (PERT)

Explanation: PERT is used for projects with uncertain activity durations (like research and development) and focuses on the probability of completing the project by a certain date.

13. The structural member placed over an opening (like a door or window) to support the load from the structure above is a:

A) Lintel

B) Joist

C) Sill

D) Arch

Answer: A) Lintel

Explanation: Lintels can be made of reinforced concrete, steel, timber, or stone. They carry the load of the masonry or wall above the opening and transfer it to the side walls.

14. The horizontal distance between two consecutive contour lines on a map is known as the:

A) Contour interval

B) Contour gradient

C) Horizontal equivalent

D) Vertical equivalent

Answer: C) Horizontal equivalent

Explanation: The horizontal equivalent indicates the steepness of the slope. A small horizontal equivalent means a steep slope, while a large horizontal equivalent indicates a flatter slope. The contour interval is the constant vertical distance between the lines.

15. In soil mechanics, the ratio of the weight of water to the weight of the solid particles in a soil mass is the:

A) Void ratio

B) Porosity

C) Degree of saturation

D) Water content

Answer: D) Water content

Explanation: Water content (w), also known as moisture content, is a fundamental index property of soil and is expressed as a percentage. It is determined by oven-drying a soil sample.

16. The phenomenon of flow in which the fluid layers slide smoothly over one another is called:

A) Turbulent flow

B) Laminar flow

C) Transitional flow

D) Rotational flow

Answer: B) Laminar flow

Explanation: Laminar flow occurs at low velocities and is characterized by a low Reynolds number (typically less than 2000 for pipe flow). There is no significant mixing between adjacent fluid layers.

17. The moment of resistance of a balanced reinforced concrete beam is based on the stresses in:

A) Steel only

B) Concrete only

C) Both steel and concrete reaching their permissible values simultaneously

D) Neither steel nor concrete

Answer: C) Both steel and concrete reaching their permissible values simultaneously

Explanation: A balanced section is one in which the amount of reinforcement is such that the concrete in the extreme compression fiber and the steel in tension reach their maximum allowable stresses at the same time under the applied load.

18. The process of applying small-diameter, high-velocity concrete onto a surface is known as:

A) Grouting

B) Shotcreting or Guniting

C) Plastering

D) Pre-stressing

Answer: B) Shotcreting or Guniting

Explanation: Shotcrete is used for repairing concrete surfaces, stabilizing rock slopes, and constructing thin-walled structures like tunnel linings and swimming pools. The force of the jet compacts the material upon impact.

19. The amount of water required to fill the soil pores in the root zone of a crop to its field capacity is the:

A) Field irrigation requirement

B) Net irrigation requirement

C) Consumptive use

D) Soil moisture deficiency

Answer: D) Soil moisture deficiency

Explanation: This is the amount of water that needs to be applied during irrigation to bring the soil moisture level from its existing state up to the field capacity, which is the optimal level for plant growth.

20. A traffic engineering study that involves collecting data on the number and types of vehicles passing a specific point is a:

A) Speed and delay study

B) Origin-destination study

C) Traffic volume study

D) Parking study

Answer: C) Traffic volume study

Explanation: Traffic volume data is fundamental to transportation planning and design. It is used to determine road capacity, design signal timings, and identify traffic trends.

21. The period after which a building is expected to become economically unviable for its original purpose is its:

A) Physical life

B) Economic life

C) Design life

D) Functional life

Answer: B) Economic life

Explanation: The economic life of a building or asset is the period over which it is more cost-effective to keep it in service than to replace it. It ends when the costs of maintenance and operation exceed the benefits it provides.

22. The satellite system that provides positioning, navigation, and timing services on a global basis is:

A) GIS (Geographic Information System)

B) GPS (Global Positioning System) or GNSS (Global Navigation Satellite System)

C) LiDAR (Light Detection and Ranging)

D) RADAR (Radio Detection and Ranging)

Answer: B) GPS (Global Positioning System) or GNSS (Global Navigation Satellite System)

Explanation: GNSS is the generic term for satellite navigation systems. GPS is the system operated by the United States. Other systems include Russia's GLONASS, Europe's Galileo, and China's BeiDou.

23. A floor covering made from a mixture of linseed oil, cork dust, wood flour, and pigments, pressed onto a burlap or canvas backing, is:

A) Vinyl flooring

B) Linoleum

C) Terrazzo

D) Mosaic

Answer: B) Linoleum

Explanation: Linoleum is a traditional, durable, and environmentally friendly flooring material known for its resilience and water resistance.

24. A steel beam that is built up from plates and angles to create a deep section capable of spanning long distances is a:

A) Rolled steel joist

B) Castellated beam

C) Plate girder

D) Gantry girder

Answer: C) Plate girder

Explanation: Plate girders are custom-fabricated I-beams used in bridges and industrial buildings where standard rolled sections are not deep or strong enough to carry the applied loads.

25. The pressure in a fluid that is measured relative to the local atmospheric pressure is known as:

A) Absolute pressure

B) Gauge pressure

C) Vacuum pressure

D) Stagnation pressure

Answer: B) Gauge pressure

Explanation: Gauge pressure is what is typically measured by pressure gauges. Absolute pressure is the sum of gauge pressure and atmospheric pressure ($P_{abs} = P_{gauge} + P_{atm}$).

26. The property of a liquid that enables it to resist tensile stress is:

A) Viscosity

B) Surface tension

C) Capillarity

D) Vapor pressure

Answer: B) Surface tension

Explanation: Surface tension is a cohesive effect caused by the imbalance of intermolecular forces at the surface of a liquid. It allows the liquid to form droplets and supports small objects, like insects, on its surface.

27. The point on the stress-strain curve for a material beyond which the material undergoes large strains with little or no increase in stress is the:

A) Proportional limit

B) Elastic limit

C) Yield point

D) Ultimate stress point

Answer: C) Yield point

Explanation: The yield point marks the onset of plastic deformation. For materials like mild steel, it is a distinct point on the curve where the material "yields" and begins to deform permanently.

28. The part of a dam or weir over which excess water flows is the:

A) Sluice gate

B) Spillway

C) Gallery

D) Abutment

Answer: B) Spillway

Explanation: The spillway is a crucial safety feature of a dam, designed to safely discharge floodwaters and prevent the dam from being overtopped, which could lead to its failure.

29. The unit of measurement for sound intensity or noise level is the:

A) Hertz (Hz)

B) Decibel (dB)

C) Lux (lx)

D) Candela (cd)

Answer: B) Decibel (dB)

Explanation: The decibel scale is a logarithmic scale that compares the intensity of a sound to a reference level. It is used in environmental engineering to assess noise pollution.

30. The component of a building's plumbing system that prevents sewer gases from entering the building is the:

A) Vent pipe

B) Soil pipe

C) Waste pipe

D) Trap

Answer: D) Trap

Explanation: A trap (like the P-trap or S-trap found under sinks and toilets) is a U-shaped bend in a drainpipe that holds a plug of water, creating a seal that blocks sewer gases.

31. A wall constructed with two separate leaves, or skins, with a continuous air gap in between is a:

A) Partition wall

B) Retaining wall

C) Cavity wall

D) Shear wall

Answer: C) Cavity wall

Explanation: The air cavity in a cavity wall provides excellent thermal insulation and prevents moisture from penetrating from the outer leaf to the inner leaf of the wall.

32. The process of establishing a series of benchmarks along a route for construction purposes is known as:

A) Traverse surveying

B) Profile levelling

C) Contouring

D) Triangulation

Answer: B) Profile levelling

Explanation: Profile levelling is used to determine the elevations of points along a line, such as the centerline of a proposed road, sewer, or canal, to create a longitudinal section or profile.

33. The maximum dry density of a soil is achieved at the:

A) Liquid limit

B) Plastic limit

C) Optimum moisture content (OMC)

D) Shrinkage limit

Answer: C) Optimum moisture content (OMC)

Explanation: In a standard proctor compaction test, the OMC is the water content at which a specified compactive effort produces the highest dry density. The water acts as a lubricant, allowing soil particles to pack more closely together.

34. The buoyant force on a submerged body acts through the:

A) Center of gravity of the body

B) Centroid of the displaced volume of fluid

C) Metacenter of the body

D) Center of pressure

Answer: B) Centroid of the displaced volume of fluid

Explanation: This is the core of Archimedes' principle. The point through which the buoyant force acts is called the center of buoyancy. For a body to be stable, the center of buoyancy must be positioned correctly relative to the center of gravity.

35. The bending moment in a beam is the algebraic sum of the:

A) Forces on one side of the section

B) Moments of the forces on one side of the section

C) Shear forces across the beam's length

D) Applied loads on the beam

Answer: B) Moments of the forces on one side of the section

Explanation: The bending moment at any cross-section of a beam represents the internal resistive moment that balances the external moments caused by the applied loads and reactions on either side of that section.

36. A column is considered to be a "short" column if its failure is governed primarily by:

A) Buckling

B) Direct crushing of the material

C) Torsion

D) Shear

Answer: B) Direct crushing of the material

Explanation: Short, stocky columns fail when the compressive stress reaches the material's yield or crushing strength. Long, slender columns, on the other hand, are prone to failure by buckling at a much lower stress.

37. The process of joining two steel members by heating them to a suitable temperature and hammering or pressing them together is:

A) Welding

B) Riveting

C) Bolting

D) Forging

Answer: D) Forging

Explanation: Forging is a manufacturing process involving the shaping of metal using localized compressive forces. While welding also involves heat, it fuses the materials together, often with a filler material.

38. The method of applying irrigation water in a series of small, level basins is known as:

A) Furrow irrigation

B) Drip irrigation

C) Check basin irrigation

D) Sprinkler irrigation

Answer: C) Check basin irrigation

Explanation: This method involves dividing a field into small, level plots (checks) surrounded by low bunds. Water is applied to fill one basin, and then it is cut off and diverted to the next. It is suitable for a wide range of crops and soil types.

39. The layer of broken stones or gravel placed under the sleepers to support a railway track is called:

A) Formation

B) Ballast

C) Subgrade

D) Embankment

Answer: B) Ballast

Explanation: The ballast serves several key functions: it distributes the load from the sleepers to the formation, provides drainage, holds the track in position, and absorbs vibrations.

40. An agreement between two or more parties that creates legally enforceable obligations is a:

A) Tender

B) Estimate

C) Contract

D) Specification

Answer: C) Contract

Explanation: A contract is a legally binding document that outlines the rights and responsibilities of each party involved in a project, including the scope of work, payment terms, and timeline.

41. A vertical pipe installed in a building's plumbing system to provide air circulation and prevent the siphoning of water from traps is a:

A) Soil pipe

B) Waste pipe

C) Vent pipe

D) Downspout

Answer: C) Vent pipe

Explanation: The vent system is crucial for the proper functioning of a drainage system. It equalizes the pressure in the pipes, allowing wastewater to flow freely and preventing trap seals from being broken.

42. A shallow foundation that supports a line of load, such as from a load-bearing wall, is a:

A) Spread footing

B) Mat foundation

C) Pile foundation

D) Strip footing or wall footing

Answer: D) Strip footing or wall footing

Explanation: A strip footing is a continuous strip of concrete provided under a load-bearing wall to distribute the load over a wider area of soil.

43. The type of survey used to establish the boundaries of land parcels for legal purposes is:

A) Topographic survey

B) Engineering survey

C) Cadastral survey

D) Hydrographic survey

Answer: C) Cadastral survey

Explanation: Cadastral surveys are used to define property lines, calculate land areas, and create the maps and legal descriptions that are used in land registration and property deeds.

44. The chemical reaction between the aggregates in concrete and the alkalis in cement, which can cause expansion and cracking, is known as:

A) Sulfate attack

B) Carbonation

C) Alkali-aggregate reaction (AAR)

D) Delayed ettringite formation

Answer: C) Alkali-aggregate reaction (AAR)

Explanation: AAR is a deleterious chemical reaction that can cause long-term durability problems in concrete. It can be mitigated by using low-alkali cement or non-reactive aggregates.

45. The ratio of the volume of air voids to the total volume of a soil mass is:

A) Void ratio

B) Porosity

C) Degree of saturation

D) Air content

Answer: D) Air content

Explanation: Air content (a_c) is a measure of the proportion of the total volume of the soil that is occupied by air. It is related to porosity (n) and degree of saturation (S) by the formula $a_c = n(1-S)$.

46. The component of a centrifugal pump that converts the high-velocity flow from the impeller into a high-pressure flow is the:

A) Impeller

B) Suction pipe

C) Casing

D) Delivery valve

Answer: C) Casing

Explanation: The volute casing (or a casing with diffuser vanes) is designed with a gradually increasing cross-sectional area, which slows the fluid down, converting its kinetic energy into pressure energy according to Bernoulli's principle.

47. In structural analysis, the influence line for a given function (like reaction or bending moment) shows its variation at a specific point as:

A) A fixed load changes magnitude

B) A unit load moves across the structure

C) The temperature of the structure changes

D) The cross-section of the structure varies

Answer: B) A unit load moves across the structure

Explanation: Influence lines are a powerful tool for determining the maximum effect (e.g., maximum bending moment or shear) at a specific point on a structure (like a bridge) due to a series of moving loads.

48. The portion of rainfall that flows over the ground surface to reach a stream or river is known as:

A) Infiltration

B) Evapotranspiration

C) Surface runoff

D) Baseflow

Answer: C) Surface runoff

Explanation: Surface runoff, also called direct runoff or overland flow, is the component of precipitation that does not infiltrate into the soil or evaporate. It is the primary source of streamflow during and immediately after a storm.

49. A roadway intersection where traffic streams are separated in grade to avoid conflicts is a/an:

A) At-grade intersection

B) Roundabout

C) Interchange

D) Channelized intersection

Answer: C) Interchange

Explanation: Interchanges, such as cloverleafs or diamonds, use ramps to allow traffic on a freeway to cross or merge with traffic on another road without stopping, significantly improving safety and capacity.

50. The legal right to use another person's land for a specific purpose, such as for a driveway or a utility line, is known as an:

A) Easement

B) Encroachment

C) Ordinance

D) Lien

Answer: A) Easement

Explanation: An easement is a non-possessory right to use and/or enter onto the real property of another without possessing it. It is a common legal concept in property and construction law.

51. The process of applying a coat of molten zinc to a steel surface to protect it from corrosion is called:

A) Anodizing

B) Galvanizing

C) Painting

D) Enameling

Answer: B) Galvanizing

Explanation: The zinc coating provides both barrier protection (isolating the steel from the environment) and sacrificial protection (the zinc corrodes preferentially to the steel, even if the coating is scratched).

52. The lowest part of a roof structure that overhangs the walls of a building is the:

A) Ridge

B) Eaves

C) Gable

D) Hip

Answer: B) Eaves

Explanation: The eaves are the edges of the roof which overhang the face of a wall and, normally, project beyond the side of a building. The eaves help to throw rainwater clear of the walls.

53. The instrument used in surveying to measure horizontal and vertical angles with high precision is the:

A) Dumpy level

B) Compass

C) Theodolite

D) Clinometer

Answer: C) Theodolite

Explanation: A theodolite is a fundamental surveying instrument consisting of a telescope mounted on two perpendicular axes (horizontal and vertical), allowing it to be aimed in any direction and the corresponding angles to be read from graduated circles.

54. The shear strength of a purely cohesive soil (like a saturated clay) is equal to its:

A) Angle of internal friction

B) Cohesion

C) Unconfined compressive strength

D) One-half of its unconfined compressive strength

Answer: D) One-half of its unconfined compressive strength

Explanation: For a saturated clay under undrained conditions, the angle of internal friction is considered zero ($\phi=0$). The shear strength (cohesion, c) is half the unconfined compressive strength (q_u), so $c = q_u / 2$.

55. The maximum strain at the extreme compression fiber in a concrete member in bending, as per the limit state design of IS 456:2000, is taken as:

A) 0.0020

B) 0.0035

C) 0.0045

D) 0.0055

Answer: B) 0.0035

Explanation: This is a fundamental assumption in the limit state design of reinforced concrete. It represents the ultimate crushing strain of concrete in bending, beyond which the concrete is considered to have failed.

56. The boundary layer in fluid mechanics is the thin layer of fluid near a solid surface where:

A) The velocity is zero

B) The pressure is constant

C) Viscous effects are significant

D) The flow is always turbulent

Answer: C) Viscous effects are significant

Explanation: Within the boundary layer, the fluid velocity changes from zero at the surface (the no-slip condition) to the free-stream velocity. The velocity gradient in this layer gives rise to shear stress and friction drag.

57. The type of water demand that accounts for the water required for firefighting is:

A) Domestic demand

B) Industrial demand

C) Public demand

D) Fire demand

Answer: D) Fire demand

Explanation: Although the total annual volume of water for firefighting is small, the required rate of flow can be very high. Water supply systems must be designed to deliver this high flow rate while maintaining adequate pressure.

58. The type of road intersection where all traffic from converging roads is directed into a one-way circular roadway is a:

A) Signalized intersection

B) Grade-separated interchange

C) Roundabout or Rotary

D) Staggered intersection

Answer: C) Roundabout or Rotary

Explanation: Roundabouts improve safety and traffic flow compared to traditional intersections by replacing high-speed, right-angle conflicts with low-speed merging and weaving movements.

59. A legal claim against a property for the satisfaction of a debt or obligation is a:

A) Deed

B) Easement

C) Lien

D) Lease

Answer: C) Lien

Explanation: In construction, a mechanic's lien can be placed on a property by a contractor or supplier who has not been paid for their work or materials, giving them a security interest in the property.

60. The component of a timber log that is the innermost, central part and is usually the darkest in color is the:

A) Sapwood

B) Cambium layer

C) Medullary rays

D) Heartwood

Answer: D) Heartwood

Explanation: The heartwood is dead wood that no longer transports water but provides structural support to the tree. It is generally more durable and resistant to decay than the outer sapwood.