SSC JE PRE FLT 2

SSC JE PRE 10 OCTOBER 2023 Morning

Q1 Allowance for contingencies can be expressed as a percentage of _____.
(A) total cost
(B) supervision charges
(C) establishment charges
(D) rate of each item

Q2 Which of the following problems are observed during the pouring of freshly prepared concrete in hot weather?
(i) Rapid rate of hydration of cement
(ii) Quick setting and early stiffening
(iii) Greater plastic shrinkage
(iv) More finishing times
(A) Only (i)
(B) Both (i) and (ii)
(C) (i), (ii), (iii) and (iv)
(D) Only (i), (ii) and (iii)

Q3 In soil mechanics, the number and disposition of bore holes are varied, depending upon the_____.
(A) earth surface
(B) atmosphere
(C) subsoil condition
(D) underground water

Q4 In general shear failure, continuous failure is developed between _____.
(A) ground surface and the footing
(B) soil and failure surface
(C) edge of the footing and ground surface
(D) foundation and ground surface

Q5 The formula for specific gravity of fine aggregates as per IS 2386 (part 3) 1963, using the pycnometer is by the following: Specific gravity $= \frac{W_2 - W_1}{W_2 - W_1 - W_3 - W_4}$
Where -
W_1 = Empty weight of pycnometer
W_2 = Weight of pycnometer + sample
W_3 = Weight of pycnometer + sample water
W_4 = Weight of pycnometer + water
(A) Correct
(B) Partially incorrect
(C) Partially correct
(D) Incorrect

Q6 The length of the horizontal transition curve based on the allowable rate change of centrifugal acceleration is 48 m, and based on the rate of introduction of super-elevation is 40 m, and based on the empirical formula, recommended by IRC is 45 m. What will be the shift in the transition curve? Take the radius of the curve as 200 m.
(A) 0.42 m (B) 0.48 m
(C) 0.33 m (D) 3.68 m

Q7 In the relation $\Delta = 8.64\ B/D$, if D is the duty in hectare/cumec and B is the number of days of base period, then Δ is the _____?
(A) depth of water in m
(B) duty in m
(C) rotation period
(D) depth of water in cm

Q8 A trapezoidal section is of depth 'y', base 'B' and side slope 'Z'. Find the wetted perimeter of the trapezoidal section.
(A) $B + 2y(1 + Z^2)^{1/2}$
(B) $2y(1 + Z^2)^{1/2}$
(C) $B + y(1 + Z^2)^{1/2}$
(D) $y(1 + Z^2)^{1/2}$

Q9 If tensile stress develops at the base of a full dam, it will be first observed at the:
(A) mid-point of the base width
(B) heel
(C) gallery
(D) toe

Q10 As per IS 800: 2007, in the case of the design of steel beams, the permissible bending stress in tension and the permissible bending stress in compression should NOT exceed ____ times the yield stress (f_y) of steel in a plastic and compact section while the beam is laterally supported.

(A) 0.45 (B) 0.66
(C) 0.75 (D) 0.60

Q11 Side face reinforcement is PROVIDED in a beam when the depth of the web exceeds _____ mm.

(A) 250 (B) 150
(C) 750 (D) 300

Q12 The captain in a vessel 0.016 km above sea level observes a 0.144 km tall lighthouse on a port just above the horizon. The distance of the vessel from the port, considering both curvature of the Earth and refraction, is _____.

(A) 161.68 km (B) 116.68 km
(C) 61.68 km (D) 16.68 km

Q13 Which of the following methods of quarrying is suitable for quarrying small, thin and regular blocks of stones from rocks such as granite and gneiss?

(A) Blasting (B) Wedging
(C) Excavating (D) Heating

Q14 The Department of Environment (DOE) method is basically used for which of the following purposes?

(i) Concrete mix design
(ii) Road mix design
(iii) Mix Design with pulverized fuel ash
(iv) Mix Design with GGBFS
(A) Both (iii) and (iv)
(B) Both (i) and (ii)
(C) (i), (ii), (iii), and (iv)
(D) Only (i), (ii), (iv)

Q15 Bamboo is commonly used in the construction of scaffoldings, bridges and structures due to its:

i. Strong fibre content
ii. Elasticity
iii. Tensile strength
(A) All of (i), (ii) and (iii) are correct.
(B) Only (i) is correct.
(C) Only (ii) is correct.
(D) (i) and (iii) are correct.

Q16 While using grading limits of the Zone-IV sand for mortars, what is the percentage of sand that should pass through a 600 μ IS sieve?

(A) 40% - 100% (B) 70% - 100%
(C) 80% - 100% (D) 0% - 15%

Q17 The angle of intersection of two straights is 120°. Find the ratio of the length of long chord to the tangent length.

(A) $\sqrt{3}$ (B) 1
(C) $1\sqrt{3}$ (D) 0.866

Q18 In plane surveying, level lines are considered as_____ and plumb lines are considered as_____.

(A) parallel; straight
(B) straight; straight
(C) parallel; parallel
(D) straight; parallel

Q19 For an RCC beam of width 230 mm and effective 300 mm subjected to a shear force of 69 kN due to loads what will be the nominal shear stress in the beam?

(A) 10 N/mm^2 (B) 1 N/mm^2
(C) 0.01 N/mm^2 (D) 0.1 N/mm^2

Q20 Polar moment of inertia about central axis of a semi-circular lamina with radius R is given as____.

(A) $\frac{\pi R^4}{2}$ (B) $\frac{\pi R^4}{8}$
(C) $\frac{\pi R^4}{4}$ (D) $\frac{\pi R^4}{16}$

Q21 Select the correct option for the given statements.

Statement 1 : Laminates are the production made by bonding together two or more layers of materials.

Statement 2: High-pressure decorative

laminates are pasted on plywood sheets, which are used for large areas like cabinets, wide door shutters, tables, etc.

(A) Both statement 1 and statement 2 are false.
(B) Both statement 1 and statement 2 are true.
(C) Statement 1 is false and statement 2 is true.
(D) Statement 1 is true and statement 2 is false.

Q22 Which of the following is/are NOT the characteristic of traffic actuated signals?

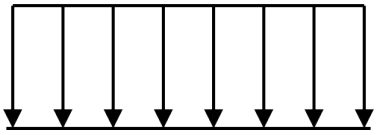
i. It is costly.
ii. The cycle time changes as per traffic demand.
iii. The cycle time changes as per the time of the day.
iv. Computers and detectors are used to operate this signal.

(A) Both ii and iv
(B) Both iii and iv
(C) Only iii
(D) Only ii

Q23 Calculate the charges for a truck (diesel) to transport material for 8 hours in a day with a rate of ₹ 200/hour.

(A) ₹ 1,000 (B) ₹ 1,500
(C) ₹ 1,600 (D) ₹ 2,000

Q24 A rectangular shape of stress distribution diagram at the base of a circular chimney is shown in figure. By referring to it, it may be concluded that _____?



(A) The chimney is subjected to bending stress only
(B) The chimney is subjected to both bending as well as direct compressive stress
(C) The chimney is subjected to direct compressive stress only
(D) The chimney is subjected to wined pressure only

Q25 As per IS 456:2000, the design bond stress τ_{bd} in limit state method for bars is tension for M40 grade of concrete is _____.

(A) 1.2 N/mm^2 (B) 1.7 N/mm^2
(C) 1.5 N/mm^2 (D) 1.9 N/mm^2

Q26 Find the discharge of water flowing over a rectangular notch of length 1m when the constant head over the notch in is 100 mm. Take C_D = 0.60. Given $\sqrt{2g} = 4.43$.

(A) 56.8 litres/sec
(B) 52.8 litres/sec
(C) 48.5 litres/sec
(D) 62 litres/sec

Q27 During the construction of sloped timber roof truss, for protection of timber, which of the following is essential?

(A) One coat of primer
(B) Two coats of paint over primer
(C) One coat of paint
(D) Non Priming and no painting

Q28 A road has a design speed of 20 m/s and the radius of the horizontal curve is equal to 250 m. Design the super-elevation that is needed on this road, with lateral friction coefficient value of 0.15. (Take g = 10 m/s^2)

(A) 0.09 (B) 0.22
(C) 0.16 (D) 0.07

Q29 Allowable bearing capacity is defined as.

(A) net ultimate bearing capacity/FOS
(B) net safe bearing capacity + γD_f
(C) net loading intensity at which soil just fails in shear
(D) net loading intensity at which neither shear failure nor settlement failure occurs in soil

Q30 The design criterion for laterally supported steel beams with respect to crippling recommends that the maximum permissible bearing stress should NOT exceed _____ times of the yield stress of steel (f_y).

(A) 0.66 (B) 0.80
(C) 0.40 (D) 0.75

Q31 If detailed drawings are not available, the steel reinforcement may be calculated approximately on the percentage basis of_____?
(A) concrete
(B) brickwork
(C) size of bending
(D) height of building

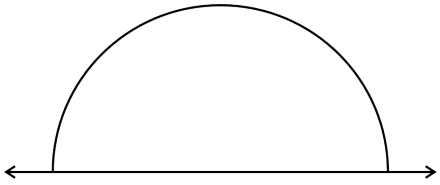
Q32 According to IS 456:2000, for a cantilever beam the effective length of the cantilever shall be taken as.
(A) clear span of the beam + half the effective depth
(B) clear span of the beam + half the width of the support
(C) clear span of the beam + width of the support
(D) clear span of the beam + effective depth

Q33 Which of the following methods is used for measuring earthwork?
(A) Area and volume shall be nearest worked out 0.01 m^2 and 0.01 m^3
(B) Volume shall be worked out to nearest to 0.02 m^3
(C) Area and volume shall be worked out to nearest to 0.03 m and 0.03 m
(D) The area shall be worked out to nearest to 0.02 m^2

Q34 The length of a long wall in the long and short wall method of estimation is centre to centre distance between the walls and_____?
(A) one-fourth width of wall on each side
(B) half of its width on each side
(C) width of the wall
(D) one-third width of wall on each side

Q35 Which of the following is a rain gauge adopted as the standard recording type rain gauge in India? Its details are described in IS : 5253 - 1969.
(A) Tipping-bucket type rain gauge
(B) Natural siphon of Float type rain gauge
(C) Tipping & weighing rain gauge
(D) Weighing-bucket type rain gauge

Q36 A semicircular lamina has radius R and diameter D. Determine the moment of inertia about the diametrical axis as shown below?



(A) $\frac{\pi D^4}{32}$ (B) $\frac{\pi R^4}{16}$
(C) $\frac{\pi D^4}{64}$ (D) $\frac{\pi R^4}{8}$

Q37 To avoid gas bounding, the pump is:
(A) elevated (B) charged
(C) primed (D) heated

Q38 The vertical distance between the centre line of a pump and the point of delivery is known as _____.
(A) delivery head (B) total head
(C) suction head (D) dynamic head

Q39 Select the correct option for the given statements.
Statement 1: The placing of veneers normal to each other increases the longitudinal and transverse strength of plywood.
Statement 2: Plywood possesses uniform tensile strength in all directions.
(A) Both statement 1 and statement 2 are true
(B) Both statement 1 and statement 2 and false
(C) Statement 1 is true and statement 2 is false
(D) Statement 1 is false and statement 2 is true

Q40 Which of the given option is NOT recommended as a desirable property of the transporting truck used for collection of municipal solid waste?
(A) Strength and durability
(B) Water-tightness
(C) Sharp corners and edges
(D) Made of stainless steel

Q41 Calculate the total charge given to three laborers for their earthwork excavation, with them working from 9 a.m. to 6 p.m. with an hourly working charge of ₹ 50.

(A) ₹ 1,350 (B) ₹ 450
(C) ₹ 350 (D) ₹ 500

Q42 Which of the following assumptoins is NOT valid in case of design of axially loaded compression members in the steel design?
(A) The modulus of elasticity is assumed to be constant in a built-up column.
(B) The ideal column is assumed to be absolutely straight with no crookedness.
(C) The modulus of elasticity is assumed to vary in a built-up column.
(D) Secondary stresses are neglected.

Q43 _____ is the correct formula to determine the elevation difference (d_Z) between two points on the ground using a total station.
(V_D = Vertical difference, H_I = Instrument height and H_R = Reflector height)
(A) $d_z = V_D - (H_I + H_R)$
(B) $d_z = V_D (H_I + H_R)$
(C) $d_z = V_D (H_I - H_R)$
(D) $d_z = V_D + (H_I - H_R)$

Q44 A revised estimate is prepared.
(A) when the sanctioned estimate is likely to exceed more than 5%, without structural alternation
(B) when there is material deviation of structured nature
(C) when the sanctioned estimate is likely to exceed more than 5%, with important structural alternations
(D) when the expendiature of the work exceeds 20% of the administrative approval

Q45 If a curve setup on a highway has a deflection angle of 120° between its tangents and a versine distance of 225 m, then the sharpness of the curve subtended by an arc of length 30 m will be _____.
(A) 5° (B) 3°
(C) 4° (D) 6°

Q46 Select the optoin that is appropriate regarding the following two statements labeled Assertion and Reason.
Assertion : Social upliftment of the people in rural areas can be achieved by implementing proper irrigation practices.
Reason: Irrigation will create a lot of employment opportunities for rural people.
(A) Assertion is true, but Reason is false.
(B) Both Assertion and Reason is false.
(C) Both Assertion and Reason are true and Reason is the correct explanation of Assertion.
(D) Both Assertion and Reason are true and Reason is not the correct explanation of Assertion.

Q47 In case of welded connection in steel structures, during welding, a defect is caused by coating of the parent metal with a foreign matter and because the groove is not kept clean This defect is known as
(A) lack of fusion
(B) overlap
(C) incomplete penetration
(D) slag inclusino

Q48 If the pipes are connected in series, then the
(A) discharge will be high and the pressure will be low
(B) discharge will be low the pressure will be constant
(C) discharge will be constant and the pressure will be low
(D) discharge will be constant and the pressure will be high

Q49 As per IS 800: 2007, which of the following statements is correct regarding the maximum slenderness ratio?
(A) The maximum slenderness ratio of a member carrying compressive loads resulting from dead load and imposed loads should not exceed 350.
(B) The maximum slenderness ratio of a member carrying compressive loads resulting from

dead load and imposed loads should not exceed 250.

(C) The maximum slenderness ratio of a member carry compressive loads resulting from dead load and imposed loads should not exceed 180.

(D) The maximum slenderness ratio of a member carry compressive loads resulting from dead load and imposed loads should no exceed 200.

Q50 Consider width of road 7.2 m and pedestrian speed of 1.2 m/s, find green time for pedestrian. Consider initial walk time as 7 s.

(A) 14 s (B) 26 s

(C) 6 s (D) 13 s

Q51 Shear resistance of soil can be attributed to.

(A) only friction

(B) cohesion and plasticity

(C) cohesion and friction

(D) cohesion and pore pressure

Q52 The optimum water content (OWC) is the moisture content at which the soil attains _____.

(A) maximum dry density

(B) maximum water content

(C) minimum dry density

(D) fully saturated density

Q53 Pycnometer, wire mesh bucket and water are used to calculate which characteristic property of the coarse aggregate?

(A) Crushing strength

(B) Attrition

(C) Impact value

(D) Specific gravity

Q54 Which of the following statements is INCORRECT?

(A) Collection efficiency of the cyclone collector is high for smaller particles.

(B) Electrostatic precipitators are widely used in thermal power plants.

(C) Electrostatic precipitators can collect dry or wet particulates.

(D) Bag filters work on the principle of interception and electrostatic attraction.

Q55 Some steps related to collection of municipal solid waste have been mentioned below.

A. Collection by sweepers in small hand driven carts.

B. Dumping into masonry chambers constructed along roadsides.

C. Collection in small containers in individual houses.

D. Collection into municipal trucks.

What is the correct sequence of the conventional system of collection of municipal solid waste, as per Indian scenario from start to end?

(A) C-A-B-D (B) C-B-A-D

(C) A-C-D-B (D) A-D-B-C

Q56 The law of flow of water through the soil was first studied by _____.

(A) Rankine (B) Boussinesq

(C) Darcy (D) Francis

Q57 Venturimeter is an application of Bernoulli's equation. Its basic principle also depends on the Bernoulli equation, which is_____?

(A) both velocity of moving fluid and pressure within fluid constant

(B) velocity of a moving fluid increases and the pressure within the fluid decreases

(C) both velocity of moving fluid and pressure within fluid increases

(D) pressure within the fluid increases and velocity of moving fluid increase

Q58 Match the following types of canals with their types of alignment.

Type of Canal	Type of Alignment
A. Ridge canal	1. Aligned roughly at right angles to the contours

B. Contour canal	2. Aligned along the watershed
C. Side slope canal	3. Aligned nearly parallel to the contours

(A) A-1, B-3, C-2 (B) A-3, B-2, C-1
(C) A-1, B-2, C-3 (D) A-2, B-3, C-1

Q59 Due to the presence of _____, the cement derives the characteristic grey colour.
(A) gypsum (B) magnesia
(C) silica (D) iron oxide

Q60 Which of the following is defined as the area of a building measured at floor level?
(A) Floor area
(B) Plinth area
(C) Circulation area
(D) Carpet area

Q61 In an aqueduct, natural drainage is _____ the canal.
(A) at the level of
(B) below
(C) above
(D) parallel to

Q62 Which of the following types of pumps can give discharge even at a high pressure?
(A) Mono-block pumps
(B) Rotary pumps
(C) Multistage pumps
(D) Single-stage pumps

Q63 Which of the following statements regarding characteristics of contour lines is INCORRECT?
(A) Contour lines of different elevation cannot cross each other.
(B) Contour lines close to one another indicate a steep slope.
(C) Contour lines of different elevations cannot intersect.
(D) Contour lines of different elevations can units to form one line only in the case of vertical cliff.

Q64 Which of following statements is incorrect regarding the fineness of cement?
(A) The fineness of cement can be tested by determination of the specific surface of cement.
(B) The unit of the fineness of cement is cm^3/kg.
(C) Increase in the fineness of cement increase the drying shrinkage of concrete.
(D) The specific surface of cement can be determined by using an air permeability apparatus.

Q65 The roof of a room was considered as the BM. inverted staff reading on this BM was 3.500 m. The staff reading of point P on the ground was1.200 m. Find the RL of point P, if the RL of the bench mark is 100 m.
(A) 102.3 m (B) 95.3 m
(C) 97.7 m (D) 104.7 m

Q66 The coefficient of the volume change m_v is given by _____.
(A) $m_v = \frac{-\Delta e}{1-e_0}$
(B) $m_v = \frac{1}{\Delta\sigma'}$
(C) $m_v = \frac{-\Delta e}{1-e_0}\frac{1}{\Delta\sigma}$
(D) $m_v = \frac{-\Delta e}{1+e_0}\frac{1}{\Delta\sigma}$

Q67 In case of a remote sensing system, which of the following factors does NOT affect the property of a reflected incident radiation?
(A) Angle of incident radiation
(B) Roughness of the surface
(C) Wavelength of radiation
(D) Type of electromagnetic radiation

Q68 Select the anthropogenic source of air pollution from the given options.
(A) Burning of fossil fuels
(B) Dust storms
(C) Volcanoes
(D) Forest fires

Q69 Among the following, the correct sequence of WBM construction will be:
i. Preparation of subgrade
ii. Spreading of Coarse aggregates

iii. Application of binding material
iv. Application of screenings
v. Provision of lateral confinement
(A) i, iv, ii, iii, v
(B) i, ii, iv, iii, v
(C) ii, i, iv,v, iii
(D) i,v, ii, iv, iii

Q70 An isolated footing of RCC is supporting a pedestal. The critical section for the bending moment should be chosen at.
(A) at the face of the column
(B) halfway between the centre line and the edge
(C) a distance equal to half the depth of the column from the face of the column
(D) a distance equal to the depth of the column from the face of the column

Q71 Which of the following is an INCORRECT statement related to the height of the instrument (HI) used in leveling?
(A) The value of HI never changes while recording fore sights.
(B) The value of HI generally changes before recording back sights.
(C) The value of HI never changes while recording intermediate sights.
(D) The value of HI never changes after recording back sights.

Q72 The lining like cement concrete, pre-cast cement concrete, etc. gives a smooth surface to the canal. Smoothness of the canal bed and the sides _____the discharge of the canal and the duty of water.
(A) reduces
(B) neither reduces nor enhances
(C) doesn't affect
(D) enhances

Q73 Which of the following options is NOT considered as a component of the 3R principles of municipal solid waste management?
(A) Recover (B) Reuse
(C) Reduce (D) Recycle

Q74 As per IS:2386 (Part IV)-1963, the aggregate crushing value shall NOT exceed _____ for concrete for wearing surfaces, such as runways, roads and pavements.
(A) 10% (B) 20%
(C) 30% (D) 40%

Q75 After compacting the subgrade, by suitable methods, the tests to ensure that the desired compaction has been achieved is/are:
(A) direct shear test
(B) compaction test and triaxial shear test
(C) consolidation test
(D) moisture content and field density determination test

Q76 Which of the following types of cement gives 1-day strength that is equal to the 3-day strength of OPC with the same water content?
(A) Rapid hardening Portland cement
(B) Portland pozzolana cement
(C) Ordinary Portland cement
(D) Portland slag cement

Q77 During construction, light weight aerated concrete blocks are mostly used for.
(A) foundation
(B) shear walls
(C) load bearing walls
(D) partition walls

Q78 2 litres of an oil weigh 16 N. Calculate the specific gravity of the oil. Consider the density of water to be 998 kg/m^3.
(A) 0.816 (B) 0.846
(C) 0.786 (D) 0.856

Q79 _____ is a parameter that a total station usually does NOT measure.
(A) Horizontal angle
(B) Horizontal distance
(C) Vertical angle
(D) Slope distance

Q80 Under properly controlled combustion and temperature, what is the percentage of silica

content that can be obtained from rice husk ash?
(A) 57% – 60%
(B) 85% – 95%
(C) 40% – 50%
(D) 60% – 70%

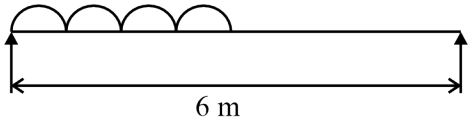
Q81 Which of the following types of signs are used for place identification and route marking?
(A) Informatory signs
(B) Warning signs
(C) Regulatory signs
(D) Prohibitory signs

Q82 There are numerous benefits of irrigation like increase in food production, development of the area and social upliftment of the people. One of the harmful effects of irrigation is _____
(A) Control of floods
(B) mosquito breading and incidence of malaria
(C) protection from famine
(D) ruralisation

Q83 If a person studies about a fluid which is at rest, the study is called.
(A) fluid kinematics
(B) fluid mechanics
(C) fluid dynamics
(D) fluid statics

Q84 If a liquid enters a pipe of diameter 'd' with velocity 'v', then what will be its velocity at the exit if the diameter of the pipe reduces to 0.5d ?
(A) v (B) 0.5 v
(C) 2 v (D) 4 v

Q85 Find the support reaction acting in the given simply supported beam of length 6 m, which is subjected to a uniformly distributed load of intensity 20 kN/m on the left half span as shown in the diagram.



(A) 30 kN (left), 30 kN (right)
(B) −20 kN (left), 80 kN (right)
(C) 45 kN (left), 15 kN (right)
(D) 15 kN (left), 45 kN (right)

Q86 _____ is a type of scale on which three successive dimensions can be measured.
(A) Engineer's scale
(B) Scale of chords
(C) Diagonal scale
(D) Vernier scale

Q87 Which of the following is an adsorption unit used for controlling gaseous pollutants in industries?
(A) Venturi scrubber
(B) Spray tower
(C) Activated carbon unit
(D) Plate tower

Q88 As per IS 456:2000, in the case of columns of minimum dimension of 200 mm or under, whose reinforcing bars do NOT exceed 12 mm, the nominal cover used is _____ ?
(A) 20 mm (B) 50 mm
(C) 25 mm (D) 40 mm

Q89 High water hammer pressure can cause breakage and damage to a pipeline. The property a fluid which is accountable for the problem of water hammer is _____.
(A) density
(B) fluidity
(C) surface tension
(D) viscosity

Q90 The value of average bond stress τ_{bd} depends on_____.
(A) Steel strength and Area of bar
(B) Concrete strength and Area of bar
(C) Concrete strength and Steel strength
(D) Concrete strength and type of bar

Q91 Soon before the passing of the Air Pollution Control Act, 1981 in India, an institute called NEERI had conducted a survey of the prevailing air quality in 9 major cities of India. Which of the

following cities had SO_2 concentration exceeding the maximum tolerable value of 80µg/m^3?

(A) Hyderabad (B) New Delhi
(C) Kolkata (D) Ahmadabad

Q92 Experimental water absorption tests are done on fine aggregates to find the:
(i) Water holding capacity
(ii) Strength of material
(iii) Quality of material
(iv) Shape of aggregates
(A) Only (i), (ii) and (iii)
(B) Both (i) and (ii)
(C) Only (i)
(D) (i), (ii), (iii), and (iv)

Q93 For a closed traverse, the sum of latitudes is 4 m and the sum of departures is 3 m. The closing error for the traverse would be.
(A) 3 m (B) 7 m
(C) 5 m (D) 4 m

Q94 Calculate the capital value of a building whose rent is ₹ 10,000 per annum, inclusive of all taxes. Outgoings are 18% of the gross rent, and the expected rate of return is 9% with a 60 year life of the building.
(A) 81,000 (B) 91,111
(C) 75,000 (D) 1,01,000

Q95 The rainfall observed for five successive days in a catchment is 2, 3, 4, 5 and 6 cm. Compute the direct runoff the catchment due to this rainfall. The ϕ index for the rainfall is assumed to debt be 2 cm/day.
(A) 16 cm (B) 10 cm
(C) 12 cm (D) 8 cm

Q96 During a leveling survey, the backsight of A was found greater than the foresight reading at point B. which of the following is correct?
(A) Height of instrument is required to know which point is higher.
(B) Elevation of B is more than that of A.
(C) Elevation of A is more than that of B.
(D) Either A or can have higher elevation.

Q97 The dry density decreases in cohesion less soil with an increase in water content due to which of the following reasons?
(A) Capillary rise
(B) Bulking of sand
(C) Seepage
(D) Specific gravity

Q98 Rubbish in solid waste management is a _____.
(A) putrescible solid waste
(B) Nuclear solid waste
(C) biodegradable solid waste
(D) non-putrescible solid waste

Q99 The total head that must be produced by the pump to satisfy the specific external requirements is called the?
(A) manometric head
(B) static head
(C) suction head
(D) dynamic head

Q100 A centrifugal pump with the impeller diameter of 125 mm delivers a power of 10 hp. If the impeller diameter is changed to 250 mm, what will be the power delivered by the pump if other parameters are kept constant?
(A) 100 hp (B) 80 hp
(C) 40 hp (D) 120 hp

Answer Key

Q1	(A)
Q2	(D)
Q3	(C)
Q4	(C)
Q5	(A)
Q6	(B)
Q7	(A)
Q8	(A)
Q9	(B)
Q10	(B)
Q11	(C)
Q12	(C)
Q13	(D)
Q14	(C)
Q15	(A)
Q16	(C)
Q17	(A)
Q18	(D)
Q19	(B)
Q20	(C)
Q21	(B)
Q22	(C)
Q23	(C)
Q24	(C)
Q25	(D)
Q26	(A)
Q27	(B)
Q28	(D)
Q29	(D)
Q30	(D)
Q31	(A)
Q32	(A)
Q33	(A)
Q34	(B)
Q35	(B)
Q36	(D)
Q37	(C)
Q38	(A)
Q39	(A)
Q40	(C)
Q41	(A)
Q42	(C)
Q43	(D)
Q44	(A)
Q45	(C)
Q46	(C)
Q47	(A)
Q48	(D)
Q49	(C)
Q50	(D)
Q51	(C)
Q52	(A)
Q53	(D)
Q54	(A)
Q55	(A)
Q56	(C)
Q57	(B)
Q58	(D)
Q59	(D)
Q60	(B)

Q61 (B)
Q62 (B)
Q63 (C)
Q64 (B)
Q65 (B)
Q66 (D)
Q67 (D)
Q68 (A)
Q69 (D)
Q70 (A)
Q71 (D)
Q72 (D)
Q73 (A)
Q74 (C)
Q75 (D)
Q76 (A)
Q77 (D)
Q78 (A)
Q79 (B)
Q80 (B)

Q81 (A)
Q82 (B)
Q83 (D)
Q84 (D)
Q85 (C)
Q86 (C)
Q87 (C)
Q88 (C)
Q89 (A)
Q90 (D)
Q91 (C)
Q92 (A)
Q93 (C)
Q94 (B)
Q95 (B)
Q96 (B)
Q97 (B)
Q98 (D)
Q99 (A)
Q100 (C)

Hints & Solutions

Q1 Text Solution:

Contingencies:

- It is an amount of money set aside to cover any unexpected costs that can arise throughout a construction project.
- It can be expressed as a percentage of total cost of project.
- This money is on reserve and is not allocated to any specific area of work.

For making any estimate workable, additional expenses are to be added.

The followings are the additional expenses that are to be considered during estimates:

a. Extra Expenses (contingencies) - 3 to 5%
b. Contract work establishments 1.5 to 2%
c. Tools and Machinery 1 to 1.5%
d. Contractor's profit - 10%
e. Departmental Profit - 10 to 15%

Q2 Text Solution:

Hot weather effect on concreting

- Increased water demand for required consistency.
- Rapid evaporation of mixing water.
- Rapid slump loss.
- Increased plastic shrinkage.
- Difficulty in control of entrained air.
- Possible "Cold joints".

Q3 Text Solution:

In soil mechanics, boreholes are drilled to gather information about the subsurface soil layers. The number and placement of these boreholes are crucial for obtaining representative data on the subsoil condition of the site under investigation.

Subsoil conditions that influence borehole number and disposition:

- **Soil type and stratification:** Different soil types, such as clay, sand, and rock, have varying properties like strength, compressibility, and permeability. Knowing the distribution of these soil layers is crucial for foundation design and other geotechnical applications.
- **Presence of weak zones:** Areas with soft soil, cavities, or other weaknesses need to be identified and investigated thoroughly. This might require more boreholes in these areas compared to stable ground.
- **Depth of bedrock:** Understanding the depth and characteristics of the underlying bedrock is essential for projects involving deep foundations or excavation.
- **Slope stability:** For projects on slopes, the number and location of boreholes will depend on the risk of landslides and the need to assess soil strength and drainage.

Q4 Text Solution:

General Shear Failure: This type of failure is seen in dense and stiff soil. The following are some characteristics of general shear failure.

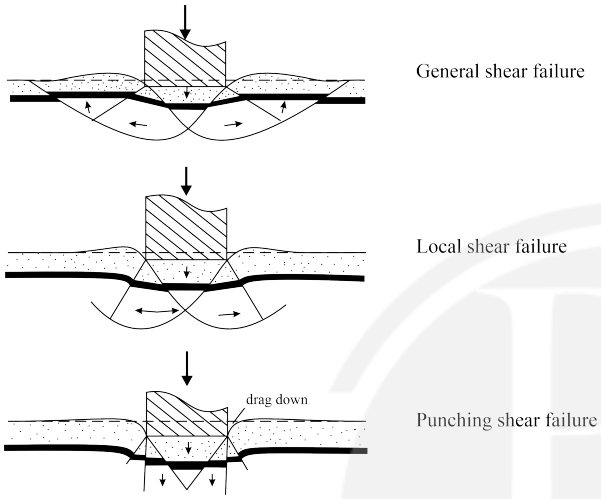
1. Continuous, well-defined, and distinct failure surface develops between the **edge of the footing and the ground surface**.
2. Dense or stiff soil that undergoes low compressibility experiences this failure.
3. Continuous bulging of shear mass adjacent to footing is visible.
4. Failure is accompanied by tilting of footing.

Local Shear Failure: This type of failure is seen in relatively loose and soft soil. The following are some characteristics of general shear failure.

1. Significant compression of soil below the footing and partial development of plastic equilibrium is observed.
2. Failure is not sudden and there is no tilting of footing.
3. The failure surface does not reach the ground surface and a slight bulging of soil around the footing is observed.
4. The failure surface is not well defined.
5. Failure is characterized by considerable settlement.

Punching Shear Failure of foundation soils: This type of failure is seen in loose and soft soil and at deeper elevations. The following are some characteristics of general shear failure.

1. This type of failure occurs in soil of very high compressibility.
2. A failure pattern is not observed.
3. Bulging of soil around the footing is absent.
4. Failure is characterized by a very large settlement



Q5 Text Solution:

According to IS 2386 (Part 3) 1963, find out the specific gravity by the pycnometer:

Specific gravity $= \frac{W_2 - W_1}{W_2 - W_1 - W_3 - W_4}$

Where,

W_1 = Empty weight of pycnometer

W_2 = Weight of pycnometer + sample

W_3 = Weight of pycnometer + sample water

W_4 = Weight of pycnometer + water

Q6 Text Solution:

Given,
Length of transition curve (L) = 48 m
Radius of the curve (R) = 200 m
For, shift in the transition curve

$$\left(S\right) = \frac{L^2}{24R} = \frac{48^2}{24 \times 200} = 0.48$$

Q7 Text Solution:

Duty: It is the number of hectares of land irrigated for full growth of a given crop by a supply of 1 cumec of water continuously during the entire base period of that crop.

Delta: The total water depth required by a crop to attain its full maturity in its base period. Base Period: The time period that elapsed from the instant of the showing of the crop to the instant of its harvesting is called the base period or crop period.

The relation between Duty (D), Delta (Δ), and Base period (B) is given as:

$\Delta = \frac{8.64B}{D}$

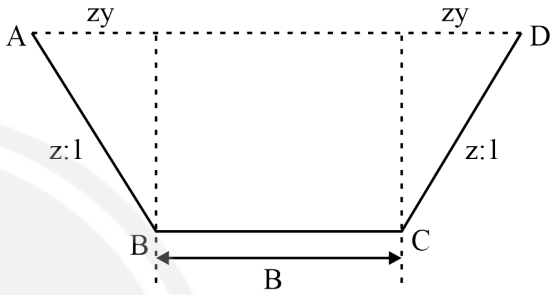
where,

D = duty in hectare/cumec.

B = base period in number of days.

Δ = depth of water in meter.

Q8 Text Solution:



Depth of trapezoidal section = y, Base = B

Side slope = 1: Z (Z = horizontal and 1 = vertical)

Area of flow = A = (B + ZY) Y

Hydraulic radius = R =Y/2

Wetted perimeter = P = B + 2y$(1 + Z^2)^{1/2}$

Q9 Text Solution:

Reservoir Conditions:

1. For reservoir full condition maximum tensile stress will be at the **heel** of the dam.
2. For reservoir full condition maximum compressive stress will be at the **toe** of the dam.
3. For reservoir empty condition maximum tensile stress will be at the **toe** of the dam.
4. For reservoir empty condition maximum compressive stress will be at the **heel**.

Q10 Text Solution:

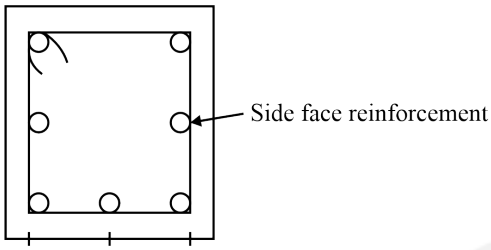
According to IS : 800 - 2007, permissible stresses in steel beams :

Type of Force	Permissible Stress
Average shear	0.40 (f_y)
Maximum shear	0.45 (f_y)

Axial tension and compression	0.60 (f_y)
Bending	**0.66 (f_y)**
Bearing	0.75 (f_y)

Q11 Text Solution:

Side face reinforcement: Side face reinforcement is longitudinal reinforcement which is provided to prevent buckling of shear reinforcement



Side face reinforcement shall be provided as per Cl. 26.5.1.3 and 26.5.17(6) of IS 456:2000

- Beam depth > 450 mm (if beam subjected to torsion)
- Beam depth > 750 mm (if beam not subjected to torsion)
- Provide @ 0.1% of web area and distribute it equally on both side faces

Q12 Text Solution:

Let, d_1 be the distance of the observer from the horizon and d_2 distance of the lighthouse from the horizon.

$d_1 = 3.8553\sqrt{h_1}\ km$

$d_2 = 3.8553\sqrt{h_2}\ km$

Where h_1 = the height of the observer's eye above the sea level (meter), h_2 = The top of the lighthouse above the sea level (meter)

$d_1 = 3.8553\sqrt{h_1}$

$d_1 = 3.8553\sqrt{16}$

$d_1 = 15.4212$ km ...(i)

$d_2 = 3.8553\sqrt{h_2}$

$d_2 = 3.8553\sqrt{144}$

$d_2 = 46.2636$ km ...(ii)

From equation (i) and (ii)

The distance of the vessel from the port (d) = $d_1 + d_2$

$d = 15.4212 + 46.2636 = 61.6848$ km

Q13 Text Solution:

The methods of quarrying the stone are as follows:

(A) Heating:

- **Heating is most suitable for quarrying small, thin, and regular blocks of stones from rocks, such as granite and gneiss.**
- A heap of fuel is piled and Fred is on the surface of the rock in a small area.
- The two consecutive layers of the rocks separate because of the uneven expansion of the two layers.
- The loosened rock portions are broken into pieces of the desired size and are removed with the help of pick-axes and crowbars.
- Stone blocks so obtained are very suitable for coarse rubble masonry.

(B) Excavating:

- Stones buried in the earth or under loose overburden are excavated with pickaxes, crowbars, chisels, hammers, etc.

(C) Blasting:

- In this method, explosives are used to convert rocks into small pieces of stones.
- This method is used when the stone to be excavated is of very hard variety and has no cracks or fissures.
- Moreover, if a stone is to be excavated on a very large scale, the blasting method will have to be adopted.
- After blasting, the excavated stone is sorted into different sizes and categories.
- Explosives such as blasting powder, blasting cotton, dynamite, and cordite are used.

(D) Wedging:

- This method is mainly used for the rocks of sedimentary type, which is comparatively soft, such as sandstone, limestone, marble, slate, and laterite.
- In this method, first of all naturally occurring cracks or fissures are located in the rocks, to be excavated.
- The steel wedges or points are then driven with the help of a hammer, in hammer fissures or cracks and stones are detached.

- The split-out blocks of stone can be converted into marketable forms and supplied to users.

Q14 Text Solution:

The Department of Environment's Design Method (DOE Method):

This method of concrete mix design or proportioning mainly is based on the extensive field and laboratory experiments carried out by Road Research Laboratory U.K.

The Department of Environment method is used for:

1. Concrete mix design
2. Concrete Pavement mix design
3. Concrete Mix Design with pulverized fuel ash
4. Concrete Mix Design with Ground granulated blast furnace slag (GGBFS)

Q15 Text Solution:

Bamboo as a building material has high compressive strength and low weight and has been one of the most used building materials as support for concrete, especially in those locations where it is found in abundance. Bamboo as a building material is used for the construction of scaffolding, bridges and structures, and houses.

Advantages of Bamboo as a Building Material

The various advantages of bamboo are mentioned below:

1. Tensile strength: Bamboo has higher tensile strength than steel because its fibers run axially.

2. Fire Resistance: The capability of bamboo to resist fire is very high and it can withstand temperatures up to 4000 °C. This is due to the presence of high values of silicate acid and water.

3. Elasticity: Bamboo is widely preferred in earthquake-prone regions due to its elastic features.

4. Weight of bamboo: Bamboo due to its low weight is easily displaced or installed making it very easy for transportation and construction.

5. Unlike other building materials like cement and asbestos, bamboo poses no danger to health.
6. They are cost-effective and easy to use.
7. They are especially in great demand in earthquake-prone areas.

Q16 Text Solution:

As per IS:383, recommends the following grading limit for fine aggregates:

Sieve Size (mm or micron)	Grading Zone-I	Grading Zone-II	Grading Zone-III	Grading Zone-IV
10 mm	100	100	100	100
4.75 mm	90-100	90-100	90-100	95-100
2.36 mm	60-95	75-100	85-100	95-100
1.18 mm	30-70	55-90	75-100	90-100
600 micron	15-34	35-59	60-79	80-100
300 micron	5-20	8-30	12-40	15-50
150 micron	0-10	0-10	0-10	0-15

Q17 Text Solution:

Given,

Angle of intersection = 120°

Deflection angle (Δ)=180° – angle of intersection

(Δ) = 180° – 120° = 60°

$$\text{Ratio} = \frac{\text{Length of long chord (L)}}{\text{Tangent length (T)}}$$

$$= \frac{2R\sin\frac{\Delta}{2}}{R\tan\frac{\Delta}{2}} = 2\cos\frac{\Delta}{2}$$

$$= 2\cos\frac{60^\circ}{2} = 2\cos 30^\circ$$

$$= 2 \times \frac{\sqrt{3}}{2} = \sqrt{3}$$

Q18 Text Solution:

Plane Surveying

- In this type of surveying, the mean surface of the earth is considered as a plane, and the spheroidal shape is neglected.
- All triangles formed by survey lines are considered plane triangles.

- **The level line is taken as straight, and all plumb lines are considered to be parallel.**
- Plane surveying is done for smaller areas in consideration i.e Areas < 195km^2

Q19 Text Solution:

Given,

Width of beam (B) = 230 mm

Effective depth of beam (d) = 300 mm

Shear force (V) = 69 kN = 69 × 10^3 N

Nominal shear stress $\left(\tau\right) = \frac{v}{Bd}$

$= \frac{69 \times 10^3}{230 \times 300}$

= 1 N/mm^2

Q20 Text Solution:

- Polar Moment of Inertia is a measure of an object's capacity to oppose or resist torsion when some amount of torque is applied to it on a specified axis.
- Polar Moment of inertia also known as the second polar moment of area is a quantity used to describe resistance to torsional deformation.
- It is denoted as I, or J.

Moment of inertia of the circle :

$I_{xx} = I_{yy} = \frac{\pi r^4}{4}$

$I_p = I_{xx} + I_{yy} = \frac{\pi r^4}{4} + \frac{\pi r^4}{4} = \frac{\pi r^4}{2}$ (for circle)

Area moment of inertia of circle is :

$I_p = \frac{\pi r^2}{2}$

Area moment of inertia of a semi circle would be half of that of a circle

$I_{xx} = I_{yy} = \frac{\pi r^4}{8}$

By adding "xx" axis and "yy" axis

$I_p = I_x + I_y = \frac{\pi r^4}{8} + \frac{\pi r^4}{8} = \frac{\pi r^4}{4}$

Q21 Text Solution:

Laminates: Laminates are constructed by bonding together multiple layers of different materials. They offer several advantages like increased strength, flexibility, and resistance to heat and wear.

High-pressure decorative laminates are commonly used for surfaces on furniture, walls, and other interior design elements. Plywood sheets typically serve as the substrate for these laminates in larger applications like cabinets, doors, and tables.

Q22 Text Solution:

Actuated signals

- In this type of signal system, signal timings are completely influenced by the traffic volume as detected on all approach roads(where as it is not influenced as per the time of the day)
- Initial cost is very high for the installation of traffic signals.
- Sensors and detectors are used to operate the signals.

Semi actuated signal

- In this type of signal system, timings are affected when vehicles are detected.
- Suitable only when low volume Road intersects, high volume Road.

Fixed time signal

- The timing of each phase of the cycle is fixed based on the traffic studies.
- Signals time cycle does not change with respect to the change in traffic flow at the intersection.

Q23 Text Solution:

Given,

Charges of truck per hour = Rs. 200

Work in a day = 8 hours

Total charges per day = Total hours × charge of truck per hour

= 200 × 8 = Rs. 1600

Q24 Text Solution:

Stress distribution diagram at the base of a circular chimney:

Wind pressure(P) acting on the chimney

• Let wind pressure(P) kN/m^2 act on the left side of the chimney the height and diameter of the chimney are h and D respectively.

• The direct stress is the same base on the chimney because the weight or load of the chimney is uniformly distributed in the base area.

Direct stress $\left(\sigma_d\right) = \frac{\text{Weight of Chimney (W)}}{\text{Area of Chimney (A)}}$

• Bending stress at the base of the chimney due to wind pressure

Bending stress $\left(\sigma_b\right) = \frac{M}{Z}$

Where,

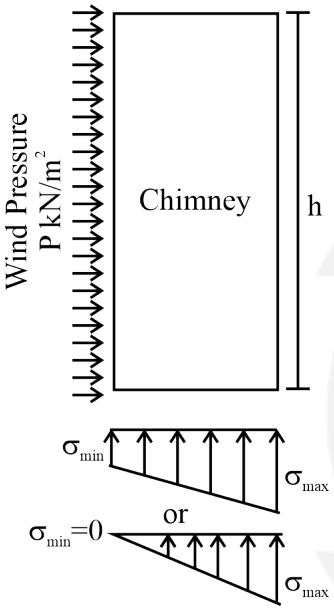
M = Moment generated due to wind pressure

Z = Section modulus of chimney

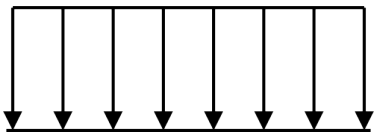
Let the maximum stress at the base of the chimney be σ_{max} and the minimum stress at the base of the chimney be σ_{min}.

$\sigma_{max} = \sigma_d + \sigma_b$

$\sigma_{min} = \sigma_d - \sigma_b$



• As the question σ_{max} is equal to σ_{min}, we can conclude that there is no bending force occurring due to wind action and hence only force acting on base is its own dead load(direct compressive load) and the stress diagram will look like below.



Q25 Text Solution:

As per IS 456:2000

The values of bond stress are for plain bar in tension

Grade of Concrete	M15	M20	M25	M30	M35	M40
WSM	0.6	0.8	0.9	1	1.1	1.2
LSM	-	1.2	1.4	1.5	1.7	1.9

Note –

- For deformed bars, these values shall be increased by 60%.
- For bars in compression, the value of bond stress for bars in tension shall be increased by 25%.

Q26 Text Solution:

Given that,

Rectangular notch length (L) = 1 m

Constant head over the notch (H) = 100 mm or 0.1 m

C_D = 0.60, $\sqrt{2g} = 4.43$

For, $Q = \frac{2}{3}C_d \times L \times \sqrt{2g} \times H^{3/2}$

$Q = \frac{2}{3} \times 0.60 \times 1 \times 4.43 \times 0.1^{3/2}$

Q = 56.035 litres/sec

Q27 Text Solution:

1. To completely seal and prime new timber we would recommend that use at least two coats.
2. The first coat is there to seal the timber and will mostly be absorbed into the wood.
3. The second coat then rejuvenates the pervious coat and gives you a smooth and complete finish.

Q28 Text Solution:

Given,

Design speed (V) = 20 m/s = 72 km/h

Radius of horizontal curve (R) = 250 m

Friction coefficient (f) = 0.15

g = 10 m/s^2

Step 1 :

$e_{equilibrium} = \frac{v^2}{225\ R} = \frac{72^2}{225 \times 250} = 0.092$

$e_{equilibrium} > e_{max}$ (0.07), then go for step 2.

Step 2 :

$e + f = \frac{v^2}{127\ R}$

$f = \frac{v^2}{127\,R_2} - e_{max}$

$f = \frac{72^2}{127 \times 250} - 0.07 = 0.093$

Here, f < 0.15, then provide, e = e_{max} = 0.07.
So, rate of super elevation is provide 0.07.

Q29 Text Solution:

Allowable bearing capacity: Allowable bearing capacity is the maximum pressure that can be applied to the soil without causing either shear failure (where the soil collapses along a certain plane) or settlement failure (where the soil compresses excessively, leading to uneven settling of structures).

Ultimate bearing capacity: It is the minimum pressure at the base of the foundation soil that fails in shear.

Safe bearing capacity: It is the maximum pressure at which soil can carry without shear failure.

Net load intensity: It is the minimum net load at which shear failure of soil can occur.

Q30 Text Solution:

As per IS 800 : 2000, permissible stresses in steel structures members:

Types of stress	Permissible stress (MPa)	Factors of safety
Axial tensile stress	0.60 fy	1.67
Max. axial compression stress	0.60 fy	1.67
Bending tensile and compressive stress	0.66 fy	1.515
Average shear stress	0.40 fy	2.5
Maximum shear stress	0.45 fy	2.22
Bearing stress	**0.75 fy**	**1.33**

Q31 Text Solution:

If detailed drawings are not available, the steel reinforcement may be calculated approximately on the percentage basis of concrete.

(i) For raft footing – 0.5% to 0.8%
(ii) For slab/lintel – 0.7% to 1%
(iii) For beams – 1% to 2%
(iv) For columns – 1% to 5%

Q32 Text Solution:

Effective span for Simply supported beam:

The effective span of a simply supported beam is taken as the least of the following:

a) Clear span + the effective depth of the beam.

b) Center to center (c/c) distance between supports.

Cantilever beam:

The effective length of a cantilever beam is taken as its length to the face of the supports + half the effective depth except where it forms the end of a continuous beam.

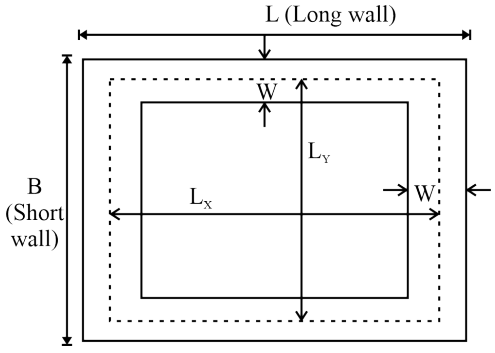
Q33 Text Solution:

Degree of accuracy (As per IS: 1200)

- Dimension shall be measured upto 0.01 m. (If it is more than 25 m it is measured upto 0.1 m)
- Area shall be measured upto 0.01 m^2
- Volume shall be measured upto 0.01m^3
- Mass shall be measured upto 1 kg.
- Wood work shall be measured upto 0.002m^3
- Reinforement shall be measured upto 0.005m
- Thickness of slab projected outside the beam or column shall be measured upto 0.005 m

Q34 Text Solution:

Long wall-short wall method/PWD method

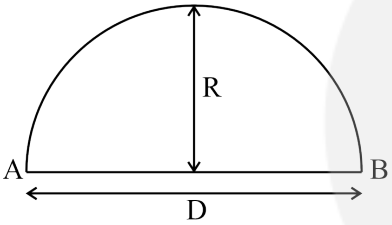


Length of long wall $= L_X + \frac{W}{2} + \frac{W}{2}$
Length of short wall $= L_Y - \frac{W}{2} - \frac{W}{2}$

Q35 Text Solution:

Recording rain gauge	Non-Recording Rain gauge
Natural syphon float type • Gives a mass curve of rainfall. • Standard rain gauge adopted in India. **Tipping Bucket type** • Installed in hilly or inaccessible areas. • Gives data on the intensity of rainfall. **Weighing Bucket type** • Gives mass curve of rainfall	**Symon's type** Most widely adopted in India as nonrecording type. • Do not record the rain but only collect the rain. Gives depth of rainfall in cm • Gives depth of rainfall in cm

Q36 Text Solution:



Moment of inertia about diametrical axis –

$I_{AB} = \frac{\pi R^4}{8}$

Q37 Text Solution:

Priming

- It is an operation in which the suction pipe, casing of the pump, and a portion of the delivery pipe are completely filled up by an water from an outside source before starting the pump.
- In other words, priming is the process in which the impeller of a centrifugal pump will get submerged in liquid without any air trap inside. It is always advisable to start pump only after priming.
- Priming is an operation that generally happens in the centrifugal pump. Priming is required in order to drive out the air voids present, which otherwise would make the operation of the pump ineffective.

Q38 Text Solution:

Different types of the head in centrifugal pump:

Manometric Head

- 'Manometric head' of a pump is the total head produced by the pump to satisfy specific external requirements. If there are no energy losses in the impeller and casing of the pump (valid in an ideal or theoretical situation only), the manometric head will be equal to the energy given to the liquid by the impeller.

$\therefore H_m = \frac{P_d}{\gamma} + \frac{V_d^2}{2g} + h - \frac{P_s}{\gamma} + \frac{V_s^2}{2g}$

Suction Head

- A suction head is a measure of the pressure experienced by a fluid on the suction side of a centrifugal pump. It is used to avoid running a pump under conditions that favor cavitation.
- The suction head refers to the difference in level between the water in the sump to the centerline of the pump.

Delivery head

- The total delivery head is defined as the work that needs to be performed by the pump to pump the medium with reference to a defined unit of weight.
- The vertical distance between the centre line of the pump and the water surface in the tank to which water is delivered is known as delivery head.

Static head

- The addition of the suction head and the delivery head is known as a static head.

Q39 Text Solution:

Plywood:

- The Bureau of Indian Standards (BIS) recommends a moisture content of 5% -15% by weight for plywood. Moisture content above or below this range can have adverse effects on the manufactured products and the environment.

- The plywood boards are prepared from thin layers of wood or veneers. So Plywood is specified by the number of layers.
- The three or more veneers in odd numbers are placed one above the other with the direction of grains of successive layers at right angles to each other.
- They are held in position by application of suitable adhesives. The placing of veneers normal to each other increases the longitudinal and transverse strengths of plywood.
- The tensile strength and compressive strength along(parallel) the grain shall be greater than that across(normal) the grain.

Q40 Text Solution:

The desirable property of the transporting truck used for collection of municipal solid waste:

(1) Strength and durability

(2) Water - tightness

(3) Made of stainless steel etc.

Strength and durability: These are essential for a truck that carries heavy loads and operates in different conditions.

Water-tightness: Prevents leaks and helps maintain hygiene by containing the waste and preventing odours.

Made of stainless steel: This material is resistant to corrosion and easier to clean, promoting better sanitation.

Note : Sharp corners and edges can cause injuries to workers during loading and unloading of waste. They can also damage containers and collection points. Therefore, smooth surfaces and rounded edges are preferred for safety and efficiency.

Q41 Text Solution:

Given,

Labours = 3

Working time = 9 am to 6 pm

Total hours = 9 hours

working charge = 50 Rupees

Charges of work, per labour in total working hours = 9 × 50 = 450 Rs.

Total charges by three labour = 1350 Rs.

Q42 Text Solution:

Compression member: A compression member is a structural member which is straight and subjected to two equal and opposite compressive forces applied at its ends.

Assumptions made while designing a compression member (or column):

- The ideal column is assumed to be absolutely straight having no crookedness, which never occurs in practice.
- The modulus of elasticity is assumed to be constant in a built-up column.
- Secondary stresses (which may be of the order of even 25%-40% of primary stresses) are neglected.

Q43 Text Solution:

Total Station

A total station is an electronic theodolite and an electronic distance meter (EDM). This combination makes it possible to determine the coordinates of a reflector by aligning the instrument's cross hairs on the reflector and simultaneously measuring the vertical and horizontal angles and slope distances.

Total Stations only measure three parameters :

1. Horizontal Angle
2. Vertical Angle
3. Slope Distance

Horizontal Distance

$H_d = S_d \cos(90 - Z_a) = S_d \sin Z_a$

where S_d is the slope distance and Z_a is the zenith angle. The horizontal distance will be use in the coordinate calculations.

Vertical Distance

$d_Z = V_D + (H_I - H_R)$

Vertical difference between two points = V_D

Instrument height = H_I

Reflector height = H_R

Elevation difference (d_z)

The quantities H_I and H_R are measure and recorded in the field. The vertical difference V_D is calculated from the vertical angle and the slope distance

$V_D = S_d \sin(90 - d_z) = S_d \cos d_z$

Q44 Text Solution:

Revised estimate

The revised estimate is a detailed estimate for revised quantities and the rate of items of works originally provided in the estimate without material deviation of a structural nature from the design originally approved for a project.

It is required to be prepared for the following reasons:

i) When a sanctioned estimate is likely to exceed by more than 5% either from the rates being found insufficient or from cause whatsoever except important structural alteration.

ii) When the expenditure of works exceeds or is likely to exceed by more than 10% of the administrative approval (for work more than 5 lakhs)

iii) When there are material deviations from the original proposal but not due to the material deviation of a structural nature.

iv) When it is found that the sanctioned estimate is more than the actual requirement.

Q45 Text Solution:

Given,

Deflection angle (D) = 120°

Versine distance (M) = 225 m

Arc length = 30 m

Mid-ordinate (M) = $R1 - \cos\frac{\Delta}{2}$

Versine $\frac{\Delta}{2} = 1 - \cos\frac{\Delta}{2}$

The mid-ordinate of the curve is also known as the versine of the curve.

$225 = R1 - \cos\frac{120°}{2}$

$225 = R1 - \cos\ 60°$

R = 450 m

$R = \frac{1720}{D}$

$D = \frac{1720}{R} = \frac{1720}{450}$

$D = 3.8° \simeq 4°$

Q46 Text Solution:

Proper irrigation practices can indeed contribute to the social upliftment of people in rural areas. This is because reliable access to water for agriculture leads to several positive outcomes:

Increased agricultural productivity: Farmers can grow more crops and have higher yields, leading to greater income and improved food security.

Diversification of crops: With stable water supply, farmers can experiment with new crops and agricultural practices, potentially increasing income and resilience.

Improved employment opportunities: Irrigation can create jobs in various sectors like construction, maintenance of irrigation infrastructure, and processing of agricultural produce.

So irrigation provide source of income , that can provide social upliftment of the people in rural areas can be achieved by implementing proper irrigation practices.

Q47 Text Solution:

Types of defects in Welding:

Incomplete Penetration

- When butt welding, incomplete penetration typically happens because the joint thickness doesn't entirely fill the space between the metals.
- This indicates that the joint is not fused on one side in the root.

Lack of fusion

- Lack of fusion results from foreign debris coating the parent metal and from improper cleaning of the groove.
- These are typically found in welds where the welding operator has improperly manipulated the electrode or employed incorrect welding variables.
- Lack of fusion problems can also result from improper joint fit and design.

Slag Inclusions

- An inclusion is a solid foreign matter that is entrapped during welding. It can be a metallic inclusion such as tungsten, copper or other metal or a slag inclusion which may be linear, isolated or grouped.
- It can also be a non-metallic inclusion such as sulphide and oxide which are a product of chemical reactions, physical effects and contamination which occurs during welding.

Over-roll/Overlap

- The weld metal that covers the parent metal surface at the weld's toe but hasn't fused to it is this. Usually brought on by an incorrect torch angle and a slow travel speed.

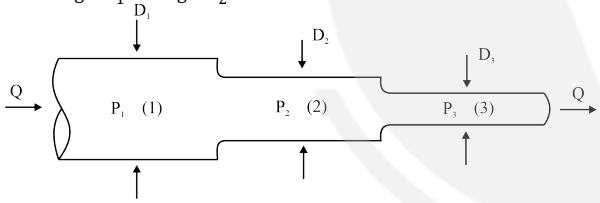
Q48 Text Solution:

(1) Pipe is connected in series–

- Pipes in series is defined of different lengths and different diameters connected end to end.
- In connection, discharge will be constant and the pressure will be high.

$Q_1 = Q_2 = Q_3$ = constant

$$H = \frac{4f_1L_1v_1^2}{2g \times d_1} + \frac{4f_2L_2v_2^2}{2g \times d_2} + \cdots$$



(2) Pipe connected in parallel–

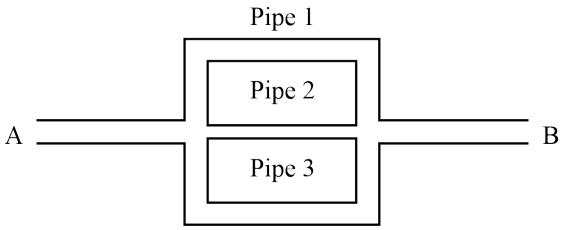
A main pipe which divides into two or more branches and again join together downstream to form a single pipe, then the branch pipes are said to connected in parallel.

The rate of flow in the main pipe is equal to the sum of rate of flow through branch pipe

$Q = Q_1 + Q_2$

In this arrangement, the loss of head for each branch pipe is same.

$$\frac{4f_1L_1v_1^2}{2g \times d_1} = \frac{4f_2L_2v_2^2}{2g \times d_2}$$



Q49 Text Solution:

Type of member	Maximum slenderness ratio
A member carrying compressive loads resulting from the dead load and the imposed load	180
A tension member in which a reversal of direct stress occurs due to loads other than wind and seismic forces	180
A member subjected to compression force resulting only from combination with wind/earthquake actions, provided the deformation of such members does not adversely affect the stress in any part of the structure	250
Compression flange of a beam against lateral torsional buckling	300
A member normally acting as a tie in a roof truss or a bracing system not considered effective when subjected to a possible reversal of stress into compression resulting from the action of wind earthquake forces.	350
Member always under tension (other than pre-tensioned members)	400

Q50 Text Solution:

Given,

Width (W) = 7.2 m

Pedestrian speed (S_p) = 1.2 m/s

Initial walk time = 7s

For Green time

$$\left(G\right) = \text{Initial walk time} + \frac{1}{\text{pedestrain speed}}$$

$$= 7 + \frac{7.2}{1.2} = 7 + 6 = 13\ s$$

Q51 Text Solution:

As per Mohr-Coulomb criteria, Shear strength of soil is given as:

$\tau = C + \sigma \tan\phi$

Where,

C is the Cohesion

σ is normal stress

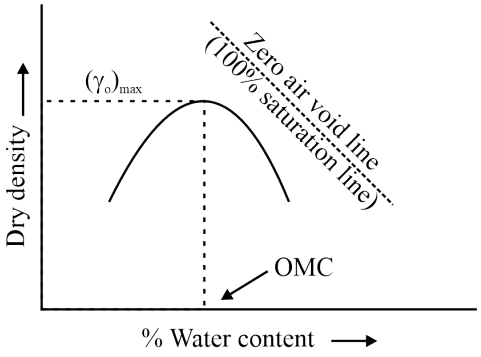
ϕ is the friction angle

From the above, it can be concluded that

1. It increases with an increase in the normal stress.
2. It is proportional to the cohesion of the soil i.e. increases with an increase in cohesion.
3. It increases with increases in friction angle.

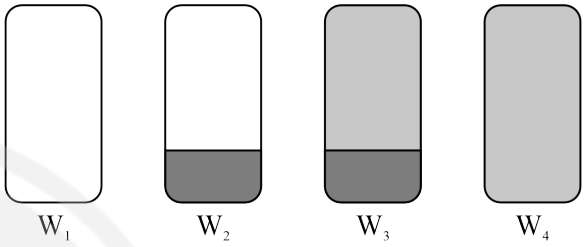
Q52 Text Solution:

Compaction Curve of Soil: The compaction curve is the curve drawn between the water content (X-axis) and the Respective dry density (Y-axis). The observation will be Initially an Increased dry density with an increase in the water content. Once it reaches a particular point a decrease in dry density is observed. The maximum peak point of the soil compaction curve obtained is called the Maximum Dry density value. The water content that corresponds to this point is called the Optimum water content (O.W.C) or Optimum Moisture Content (O.M.C).



Q53 Text Solution:

Pycnometer, wire mesh bucket and water are used to calculate Specific gravity of course aggregate. Specific Gravity is defined as the ratio of Weight of Aggregate to the Weight of equal Volume of water. The specific gravity of an aggregate is considered to be a measure of strength or quality of the material. Aggregates having low specific gravity are generally weaker than those with high specific gravity. The pycnometer method is used to determine specific gravity and water content.



W_1 = Mass of empty volume of pycnometer

W_2 = Mass of pycnometer + Mass of moist sample

W_3 = Mass of pycnometer + soil + water

W_4 = Mass of pycnometer full of water

G = Specific gravity of soil solids

The specific gravity of the soil sample is given by

$$G = \frac{W_2 - W_1}{W_2 - W_1 \cdot W_3 - W_4}$$

Q54 Text Solution:

Electrostatic precipitators

- Electrostatic precipitators are used to remove the fine particles like smoke and dust from the flowing gas.
- It is a commonly used device for air pollution control and mostly used in steel plants, thermal power plants etc.
- It uses an electric charge to remove particulate matter either in the form of solid or liquid droplets from air or other gases in smoke stacks or other flues.
- The particulates which can be dry or wet, fall into a hopper at the bottom of the unit.

- They are extremely effective and are capable of removing more than 99% of particulate matter of size smaller than 10 µm size.

Cyclone separators

- Most cyclones are built to control and remove particulate matter is larger than 10 µm. However, high efficiency cyclones are also available that are designed to remove the particles as small as 2.5 µm.
- In this system, a whirling column of gas is produced by means of axial tangential and into the cylindrical body.
- As the cylindrical body is rotated due to centrifugal force wing on the particles, It makes them move to the periphery of the gas stream and in the runs they collide with the walls of the cyclone well, thus separating them due to their mass.

Bag filters

- Bag filters operate primarily through mechanisms like interception (particles collide with and stick to the filter fibers) and, in some cases, electrostatic attraction (where charged particles are attracted to oppositely charged filter surfaces).

Q55 Text Solution:

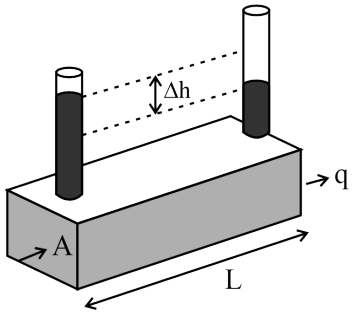
The sequence of the conventional system of collection of municipal solid waste–

1. Collection in small containers in individual houses.
2. Collection by sweepers in small hard driven carts.
3. Dumping into masonry chambers constructed long road sides.
4. Collection into municipal trucks

Q56 Text Solution:

The flow of free or gravitational water through a soil mass was first studied by **Henry Darcy** a French hydraulic engineer.

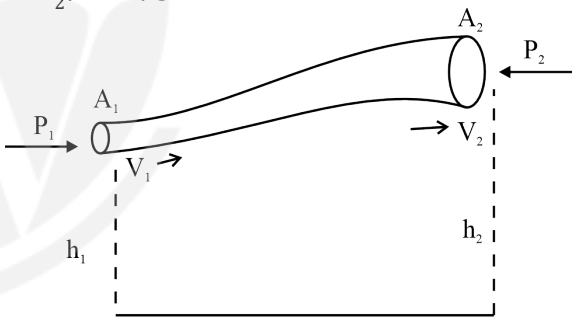
Darcy's law states that there is a linear relationship between flow velocity (v) and hydraulic gradient (i) for any given saturated soil under steady laminar flow conditions.



Q57 Text Solution:

- Bernoulli's Principle is given by Swiss physicist Daniel Bernoulli derived an expression relating the pressure to fluid speed and height in 1738.
- Bernoulli's Principle is based on the Law of conservation of energy.
- Bernoulli's Principle states that the sum of the pressure energy, kinetic energy, and potential energy per unit volume of an incompressible, non-viscous fluid in a streamlined flow remains constant.

$$P + \frac{1}{2}\rho v^2 + \rho g h = \text{constant}$$

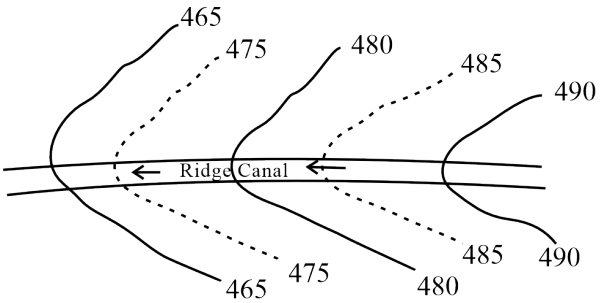


In fluid dynamics, Bernoulli's principle states that an increase in the speed of a fluid occurs simultaneously with a decrease in static pressure or a decrease in the fluid's potential energy.

Q58 Text Solution:

1. Ridge Canal

• It is also called a watershed canal.
• Aligned along the ridge or natural watershed line.
• Can irrigate areas on both sides of the ridge.
• Cross drainage work not requires.
• They are economical.

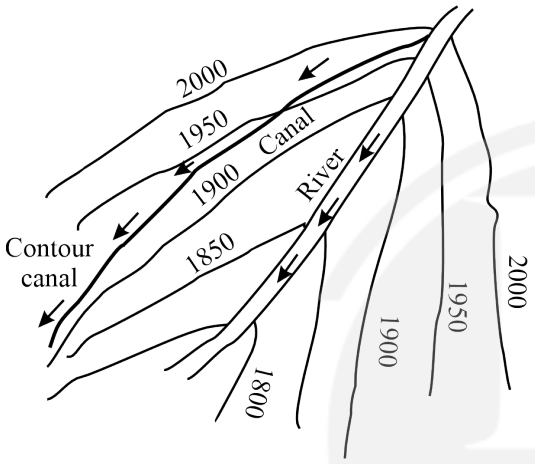


2. Contour canal

• Aligned nearly parallel to the contours of the country.

• Can irrigate areas only on one side.

• Cross drainage works are required.



3. Side Slope Canals

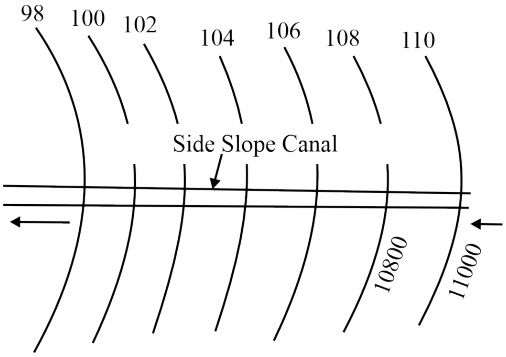
• Aligned roughly at right angles to the contour of the country.

• It is neither on the watershed nor in the valley.

• In can irrigate areas only on one side.

• It is roughly parallel to the drainage of the country, so cross drainage works are not required.

• It has a very steep bed slope



Q59 Text Solution:

Different constituents of OPC–

Constituent	Percentage Range (%)	Role in Cement
Calcium Oxide (CaO)	60-67	Primary contributor to strength and hardening through hydration reactions with water.
Silicon Dioxide (SiO_2)	20-25	Provides structure and strength to the cement matrix. Reacts with CaO to form calcium silicate minerals.
Aluminum Oxide (Al_2O_3)	4-8	Increases setting time and improves workability. Forms calcium aluminate minerals that contribute to early strength.
Ferric Oxide (Fe_2O_3)	2-6	Influences clinker color and affects setting time. Plays a role in strength development.
Magnesium Oxide (MgO)	0.5-5	Improves cement soundness and prevents excessive expansion or cracking.
Sulfur Trioxide (SO_3)	1-3	Acts as a flux during clinker formation but needs to be controlled to avoid sulfate-related expansion issues.

Q60 Text Solution:

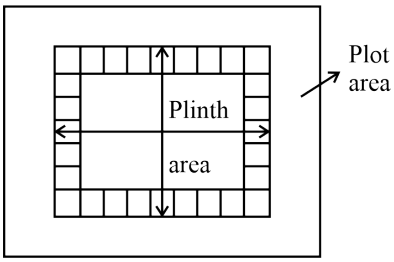
1. Plinth area– The built up covered area of a building measured at floor level of any storey.

2. Floor area– It is the plinth area excluding area of walls.

Floor area = Plinth area – Wall area

3. Carpet area– The covered area of the useable spaces of rooms at any floor is termed as carpet area.

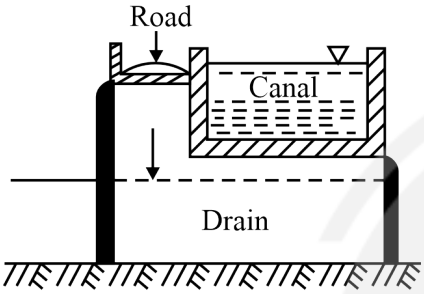
4. Circulation area– Area that is helpful in movement of people through the building around the building.



Q61 Text Solution:

Aqueduct

• An aqueduct is a hydraulic structure which carries a canal (through a trough) across and above the drainage similar to a bridge in which instead of the road or a railway, a canal is carried over a natural drain.



Aqueduct

• In the case of an aqueduct, HFL (highest flood level) of the drainage should remain lower than the level of the underside of the canal trough.

• The drain flows at atmospheric pressure under the work.

• Generally, an inspection road is provided along with the trough

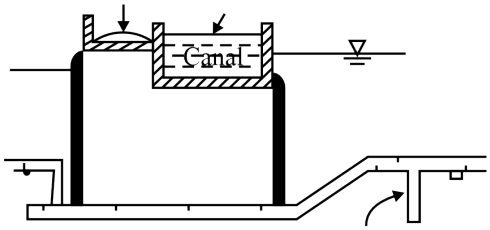
Syphon aqueduct

• A syphon aqueduct is a cross drainage structure similar to an aqueduct except that the streambed is depressed locally where it passes under the trough of the canal and the barrels discharges the streamflow under pressure.

• A syphon aqueduct is constructed where the water surface level of the drain at high flood is higher than the canal bed.

• The horizontal floor of the barrels is provided with slopes at its ends to join the drain bed on either side.

• The drain water flows under pressure through the barrels which act as inverted syphons and hence this cross drainage work is known as syphon aqueduct.



Syphon aqueduct

Q62 Text Solution:

Rotary pumps are positive displacement pumps. Rotary pumps have two or more rotating components. The discharge of rotary components remains almost the same irrespective of pressure. They can give discharge even at high pressure. In the other options, the type of pumps mentioned is all non-positive displacement types.

Q63 Text Solution:

Characteristics of Contour line:

- Closed contour lines with higher values inside show a hill. The variation of the vertical distance between any two contour lines is assumed to be uniform.
- Contour lines having the same elevations cannot unite and continue as one line. Similarly, a single contour cannot be split into two lines
- The horizontal distance between any two contour lines indicates the amount of slope and varies inversely on the amount of slope.
- The steepest slope of terrain at any point on a contour is represented along the normal of the contour at that point. They are perpendicular to ridge and valley lines where they cross such lines.
- Contours do not pass through permanent structures such as buildings.
- Contours of different elevations can cross each other in the case of caves and overhanging cliffs.
- Contours of different elevations cannot unite to form one contour (a vertical cliff is an exception).

- Equally spaced contour represents a uniform slope and contours that are well apart indicate a gentle slope.
- Closely spaced contours indicate a steep slope.
- Whereas in the case of depressions, lakes, etc. the higher figures are outside and the lower figure is inside.

Q64 **Text Solution:**

The following properties is regarding the fineness of cement–

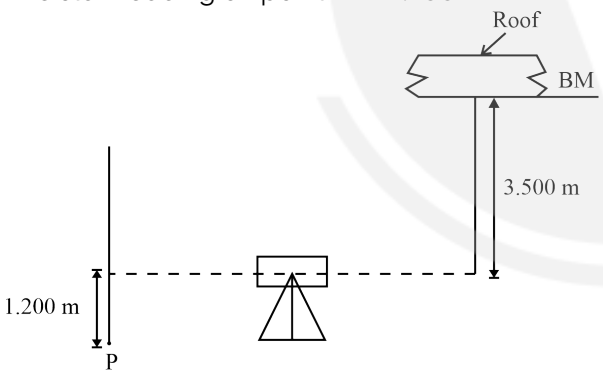
1. The fineness of cement can be tested by determination of the specific surface of cement.
2. The unit of the fineness of cement is cm^2/kg
3. Increase in the fineness of cement increase the drying shrinkage of concrete.
4. The specific surface of cement can be determined by using an air permeability apparatus.

Q65 **Text Solution:**

Given,

RL of Bench Mark = 100 m

The staff reading on point "P" = 1.200 m



Height of Instrument = RL of Bench Mark – Back Sight (in inverted condition)

HI = (100.00 – 3.500) m

HI = 96.500 m

RL of point "P" = HI – Staff reading on point "P"

= (96.500 – 1.200)m

= 95.300 m

Q66 **Text Solution:**

Coefficient of the volume change (m_v): The coefficient of volume change is defined as the volumetric strain per unit increase in applied pressure,

Thus $m_v = \frac{\frac{-\Delta V}{V_0}}{\Delta\bar{\sigma}} = \frac{\frac{-\Delta e}{1+e_0}}{\Delta\bar{\sigma}}$

$m_v = \frac{-\Delta e}{1+e_0}\frac{1}{\Delta\bar{\sigma}}$

Q67 **Text Solution:**

The following factors affect the property of reflected incident radiation:-

(1) Angle of incident radiation : The angle of incident radiation is the angle between the incoming radiation and the normal to the surface. The angle of incident radiation affects the reflection of the radiation, as it determines the amount of energy that is incident on a unit area of the surface. The smaller the angle, the more energy is incident on the surface, and vice versa.

(2) Roughness of the surface : The roughness of the surface is the degree of variation of the surface features, such as bumps, cracks, texture, etc. The roughness of the surface affects the reflection of the radiation, as it determines the mode of reflection, which can be either specular or diffuse. Specular reflection occurs when the surface is smooth and the radiation is reflected in a single direction, like a mirror. Diffuse reflection occurs when the surface is rough and the radiation is reflected in multiple direction.

(3) Wavelength of radiation : The wavelength of radiation is the distance between two successive crests or troughs of the electromagnetic wave. The wavelength of radiation affects the reflection of the radiation, as it determines the degree of interaction with the surface features, such as absorption, transmission, and reflection. Different wavelengths of radiation have different levels of penetration and sensitivity to the surface properties, such as colour, temperature, moisture, etc.

Note: The property of a reflected incident radiation depends on the wavelength of the radiation, not the type. The type of

electromagnetic radiation refers to the classification of the radiation based on its wavelength and frequency, such as visible, infrared, microwave, etc.

Q68 Text Solution:

Pollution enters the Earth's atmosphere in many different ways. The man-made sources of pollution are called anthropogenic sources.

The sources of air pollution are,

1. **Natural:** Volcanoes, forest fires, dust storms, etc.
2. **Man-made:** Gases from industries, **Burning of fossil fuels**, domestic use, automobiles, mining, nuclear power plants, nuclear explosions, etc.

Q69 Text Solution:

Water-bound macadam roads: In this method, the broken stones of the base course and surface course, if any, are bound by the stone dust in the presence of moisture. The roads whose wearing course consists of clean crushed aggregates, mechanically interlocked by rolling and bound together with filler material and water and laid on a well-compacted base course, are called water-bound macadam roads.

Process of WBM:

1. Preparation of subgrade
2. Provision of lateral confinement
3. Spreading of coarse aggregate
4. Application of screenings
5. Application of binding material

Q70 Text Solution:

(1) Cl. 34.2.3.1 of IS 456 : 2000, The bending moment at any section shall be determined by passing through the section a vertical plane which extends completely across the footing and computing the moment of the forces acting over the entire area of the footing on one side of the said plane.

(2) Cl. 34.2.3.2 of IS 456 : 2000, The greatest bending moment to be used in the design of an isolated concrete footing which supports a column, pedestal or wall shall be the moment computed in the manner prescribed in 34.2.3.1 at sections located as follows:

- At the face of the column, pedestal, or wall, for footings supporting a concrete column, pedestal, or wall;
- Halfway between the center-line and the edge of the wall, for footings under masonry walls;
- Halrfway between the face of the column or pedestal and the edge of the gusseted base, for footings under gusseted bases.

Q71 Text Solution:

Height of instrument

It is the elevation or reduced level of the line of sight with respect to the datum.

HI = Backsight + Elevation of Bench Mark

Backsight (BS) :

- It is the staff reading taken on the point of the known elevation as on a benchmark (BM) or change point. The backsight reading is the first staff reading taken after the level is set up and leveled at the point. It is also known as Plus sight.
- **The value of HI generally changes before recording back sights.**
- E.g., If the elevation of any point (P) is known then the staff reading on station P is known as a Back sight-reading.

Foresight (FS) :

- It is a staff reading taken on a point whose elevation has to be determined thorough the leveling process. It is also known as minus sight. The foresight is also taken towards a change point. It is the last reading taken before the instrument is shifted.
- The value of HI never changes while recording fore sights.
- E.g., If the elevation fo station Q is to be determiend, then the staff reading taken on station Q is called Foresight.

Intermediate sight :

- It is the staff readings taken on staff held at other points whose elevations are to be determined before the foresight is taken. Intermediate sights are all staff readings between the BS and FS.
- The value of HI never changes while recording intermediate sights.

Q72 Text Solution:

Canal lining: It is the process of covering or lining the earthen surfaces of a canal with stable, non-erodible lining surfaces such as concrete, tiles, asphalt etc. The lining gives a smooth surface to the canal.

- The smoothness of the canal bed and sides increases the velocity of flow which further increases the discharge of the canal.
- Due to the increased discharge, the duty of water will be more. So, to increase the duty, the canal surface should be made smooth.
- The lining like cement concrete, pre-cast cement concrete etc gives smooth surface to the canal.

Q73 Text Solution:

- Waste minimization can be achieved in an efficient way by focusing primarily on the first of the 3R, "reduce," followed by "reuse" and then "recycle."
- The goal of the 3R's is to educate people on how to prevent excessive and unnecessary waste and to limit the consumption of non-renewable resources.

Q74 Text Solution:

Aggregate Test	Characteristics
Crushing Test	Measures resistance to crushing under gradually applied compressive load. Aggregate crushing value should not exceed 30% for the surface course 45% for the base course
Impact Test	Measures resistance to sudden load impact. The aggregate impact value should not exceed 30% for surface course 35% for base course
Abrasion Test	Measures resistance to wear. Abrasion value should not exceed35% for bituminous concrete 50% for base course
Soundness Test	Measures resistance to weathering action. loss in weight should not exceed 12% for Na_2SO_4 and 15% for $MgSO_4$

Q75 Text Solution:

After compacting the subgrade, testing the moisture content and field density is essential to ensure the desired compaction has been achieved. Moisture content indicates the amount of water present, affecting soil density. Field density measurement assesses the compactness of the soil in its actual location. These tests collectively provide a comprehensive evaluation of the compaction process and its effectiveness.

Q76 Text Solution:

Rapid hardening portland cement (IS:8041 - 1990)

- It contains more C_3S and less C_2S than OPC.
- 1 Day strength of Rapid hardening cement (RHC) = 3 Day strength of OPC with same w/c ratio
- The initial setting time is 30 minutes and the final setting time is 600 minutes
- It hardens fast but has the same setting time as OPC.
- It is useful in cold weather concreting.
- Not used for a massive concrete structure.

Q77 Text Solution:

Light weight aerated concrete blocks

- Lightweight blocks are produced in greater volume but are less strong than dense concrete blocks.

- Lightweight concrete blocks are used in both internal and external walls where loading is slightly more restricted, or as infill blocks in beam and block flooring.
- It can also use in partition wall.

Q78 Text Solution:

V_{oil} = 2 litres

W_{oil} = 16 N

ρ_w = 998 kg/m^3

$\rho_{oil} = \frac{M}{V} = \frac{W}{g \times V} = \frac{16}{9.81 \times 2 \times 10^{-3}} = 815.494 \quad kg/m^3$

Specific gravity of oil ($S.G_{oil}$)

$\frac{\rho_{oil}}{\rho_{water}} = \frac{815.494}{998} = 0.817$

Q79 Text Solution:

Total Station: A total station is an electronic/optical instrument used in modern surveying and building construction that uses electronic transit theodolite in conjunction with an electronic distance meter (EDM). It is also integrated with a microprocessor, electronic data collector, and storage system. It is a combination of an electronic theodolite for measuring horizontal and vertical angles, an electromagnetic distance measurement (EDM) device for measurement of slop distances, and onboard software to convert the raw observed data to three-dimensional coordinates.

Hence, Total Station can directly be used to calculate- Horizontal angles, Vertical angles, and Sloping distances.

Q80 Text Solution:

Rice husk ash:

- Rice husk ash has a high surface area, which comes from the microporous structure of the ash particles.
- When obtained from controlled combustion the average composition of well-burnt RHA is 90% amorphous silica, 5% carbon, and 2% K_2O.
- Rice husk ash must be burnt at between 550°C and 800°C to achieve that state.
- The combustion process creates a secondary Calcium-Silicate-Hydrate (C-S-H) gel which determines the pozzolanic activity of the RHA.

Q81 Text Solution:

Informative Signs: The type of signs used for place identification and route marking are Informatory signs. They provide information about the location, direction, distance, and other relevant details to help travelers navigate efficiently.

Shape: Usually rectangular with a blue background and white symbols or text.

Examples: Town name signs, Exit signs, directional arrows, distance markers, rest area signs, etc.

Q82 Text Solution:

Excess irrigation and unscientific use of irrigation water may give rise to the following ill-effects :

1. **Breeding Places for Mosquitoes:** Due to excess application of water, and due to leakage of water, ponds and depressions get filled up with water and create breeding places for mosquitoes. Also, if the canal is leaky, mosquitoes breed all along the canal and spread malarial conditions.
2. **Water-Logging:** If the water table is near the ground surface, over-irrigation may raise the water table. This saturates the crop root-zone completely, causes efflorescence and the whole area becomes waterlogged.
3. **Damp Climate:** The areas which are already damp and cold, become damper and colder due to irrigation.

Q83 Text Solution:

Fluid mechanics: Fluid mechanics is that branch of science that deals with the behavior of the fluids (liquids or gases) at rest as well as in motion. Thus this branch of science deals with the static, kinematics and dynamic aspects of fluids.

Fluid statics: The study of fluids at rest is called fluid statics.

Fluid kinematics: The study of fluids in motion, where pressure forces are not considered, is called fluid kinematics.

Fluid dynamics: If the pressure forces are also considered for the fluids in motion, that branch of science is called fluid dynamics.

Q84 Text Solution:

Pipe diameter at entry (d_1) = d

Velocity (v_1) = v

Exit diameter (d_2) = 0.5d

Velocity (v_2) = ?

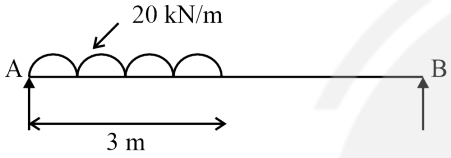
Due to continuity equation

$a_1v_1 = a_2v_2$

$\frac{\pi}{4} \times d^2 \times v = \frac{\pi}{4}(0.5d)^2 \times v_2$

$v_2 = 4v$

Q85 Text Solution:



$\Sigma fy = 0$

$R_A + R_B = 20 \times 3$

$R_A + R_B = 60$ kN

$\Sigma M_A = 0$

$20 \times 3 \times \frac{3}{2} = R_B \times 6$

R_B = 15 kN (right support)

$R_A = 60 - 15 = 45$ kN (left support)

Q86 Text Solution:

Diagonal Scales

Diagonal Scale is used to represent three consecutive units i.e. a unit and its immediate two sub-divisions. For example

(a) meter, decimeter, and centimeter

(b) kilometer, hectometer, and decameter

(c) yards, feet, and inches etc.

A diagonal scale can be measured more accurately than a plain scale.

Q87 Text Solution:

Activated carbon, also known as activated charcoal, is a form of carbon processed to have small, low-volume pores that increase the surface area available for adsorption.

Note :- Venturi scrubber, spray tower, and plate tower are not adsorption units. Venturi scrubber is a type of wet scrubber that uses a high-velocity stream of water to remove pollutants from a gas stream. Spray tower is another type of wet scrubber that uses water sprays to remove pollutants from a gas stream. Plate tower is a type of distillation column used in chemical engineering for separating liquid mixtures.

Q88 Text Solution:

The design parameters for an RCC column as per IS 456:2000, provisions are specified below:

1. In the case of columns of a minimum dimension of 200 mm or under, whose reinforcing bars do not exceed 12 mm, a nominal cover of 25 mm may be used.
2. For a longitudinal reinforcing bar in a column nominal cover shall in any case not be less than 40 mm or less than the diameter of such bar.
3. The minimum number of longitudinal bars provided in a column shall be four in rectangular columns and six in circular columns.
4. A reinforced concrete column having helical reinforcement shall have at least six bars of longitudinal reinforcement within the helical reinforcement.

Q89 Text Solution:

Water Hammer:

When a liquid flow in a long pipeline is reduced suddenly, due to the compressibility of the liquid, the sudden change in momentum would cause a pressure surge to develop. This pressure moves through the pipe at high speed and undergoes reflection at the ends and the phenomenon is known as water hammer.

The pressure rise due to water hammer depends upon the following factors:

- The velocity of flow of water in the pipe.
- The length of the pipe.

- Time is taken to close the valve or the closure of the valve.
- Elastic properties of the material of the pipe.
- **The density of fluid.**

Q90 Text Solution:

- 'Bond' in reinforced concrete is the adhesion (adhesive force) between the reinforcing steel bar and the surrounding concrete.
- The average bond stress depends on the concrete strength and the type of bar.
- Due to this bond, it is possible to transfer the axial force from the reinforcing steel to the surrounding concrete thereby introducing strain compatibility and composite/combined action of steel and concrete which avoids slippage of reinforced bars from within the concrete.

As per IS 456:2000

The values of bond stress is for plain bar in tension

Grade of Concrete	M15	M20	M25	M30	M35	M40*
WSM	0.6	0.8	0.9	1	1.1	1.2
LSM	–	1.2	1.4	1.5	1.7	1.9

- For deformed bar, the above values should be increased by 60%.
- For bar in compression, the above value should be increased by 25%.

Q91 Text Solution:

Air pollution control Act, 1981 in India–

Ambient air quality monitoring was initiated in 9 cities where zonal laboratories are located. suspended particulate matter (SPM), sulphur dioxide (SO_2), sulphation rate (SR), oxidation of nitrogen (NOx) and dust fall (DF) were selected.

Annual Summary of air quality for 1979

City	SPM ($\mu g/m^3$)	SO_2 ($\mu g/m^3$)
Mumbai	197-285	20-83
Kolkata	413-5172	28-85
Delhi	296-481	Trace-39
Hyderabad	255-295	26-27
Jaipur	222-379	Trace-17
Kanpur	206-344	10-25
Madras	106-169	10-25
Nagpur	159-386	10-12

Q92 Text Solution:

water absorption tests are conducted to find the water-holding capacity, strength of material, and quality of material. Water absorption tests can indeed provide insights into these aspects. Fine aggregates' ability to hold water is crucial for understanding their porosity and permeability, which are indicators of their quality and potential strength.

Limits: The water absorption of aggregates ranges from 0.1 to 2.0%.

Q93 Text Solution:

Given,

Sum of latitude (ΣL) = 4m

Sum of departures (ΣD) = 3 m

closing error $\left(e\right) = \sqrt{\Sigma L^2 + \Sigma D^2}$

$= \sqrt{4^2 + 3^2} = 5\,m$

Q94 Text Solution:

Given,

Total income by rent = 10,000 Rs.

Outgoing = 18% gross rent

Net Rent = Gross Rent − Outgoings

Outgoings = 0.18×10,000 = ₹1,800

Net income by rent = 10,000 – 1,800 = ₹ 8200

Rate of return (r) = 9%

Capital Value = $\frac{\text{Net Rent}}{\text{Rate of Return}}$

Capital Value = $\frac{8200}{0.09} = 91,111.11\text{Rs}$

Q95 Text Solution:

Rainfall (cm)	Time period (hrs)	ϕ-index (cm/day)	Runoff (cm)	Remark
2	1	2	0	P = ϕ
3	1	2	1	P > ϕ
4	1	2	2	P > ϕ

5	1	2	3	P > ϕ
6	1	2	4	P > ϕ

Total runoff = 0 + 1 + 2 + 3 + 4 = 10 cm in a period of 5 hours.

Q96 Text Solution:

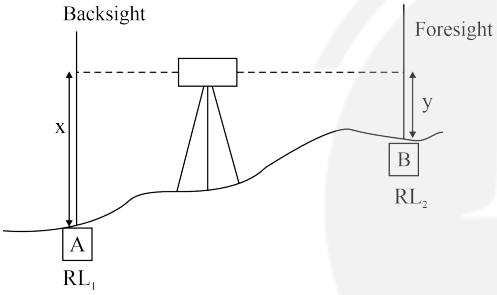
In levelling

(a) If backsight is less than foresight (BS < FS), then backsight station is at higher point than foresight station.

(b) If backsight is more than foresight (BS > FS), then backsight station is at lower point than the foresight station

So in question

During a levelling survey, the backsight of A was found greater than the foresight reading at point B. So like this elevation of B is more than that of A.



Q97 Text Solution:

The dry density of cohesionless soils such as sand decreases with a rise in water content mainly because of the phenomenon known as "bulking of sand."

When water is added to sand, a film of water forms around the sand particles leading to the increase in volume or "bulking." This thin film of water pushes the sand particles apart, which leads to an increase in the volume of the sand, consequently .

Q98 Text Solution:

Rubbish: Rubbish is a general term applied to solid wastes originating in households, commercial establishments and institutions, excluding garbage and ashes.

Rubbish in solid waste management is a nonputrescible solid waste.

The density of rubbish usually varies between 50 to 400 kg/m^3.

Q99 Text Solution:

Manometric Head (H_m) : The total head that must be produced by the pump to satisfy the specific external requirements is called the manometric head. If there are no energy losses in the impeller and casing of the pump (valid in an ideal or theoretical situation only), the manometric head will be equal to the energy given to the liquid by the impeller.

$$\therefore \quad H_m = \frac{P_d}{\gamma} + \frac{V_d^2}{2g} + h - \frac{P_s}{\gamma} + \frac{V_s^2}{2g}$$

Q100 Text Solution:

As per the affinity law, the relationship between the power and diameter of the impeller is given by:

$$P \ \alpha \ D^2$$

Where P is shaft power, D is the diameter of the impeller

Given, Delivers power (P_1) = 10 hp, Impeller diameter (d_1) = 125 mm

Delivers power (P_2) = ?, If Impeller diameter (d_2) = 250 mm

So,

$$\frac{P_2}{P_1} = \frac{D_2}{D_1}^2$$

$$\frac{P_2}{10} = \frac{250}{125}^2$$

$$\frac{P_2}{10} = 4$$

P_2 = 40 hp