

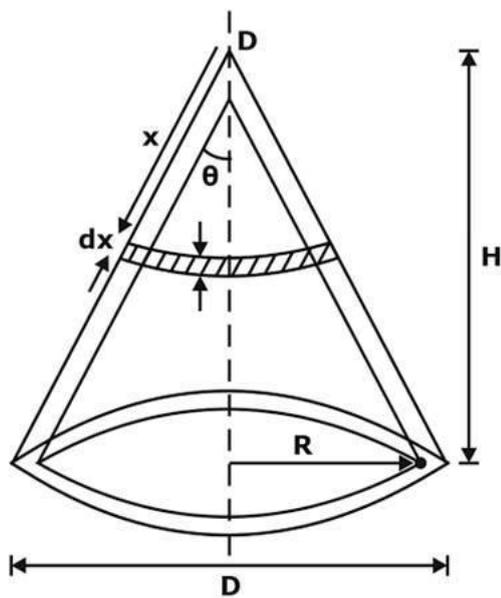
1. The centre of gravity of a right circular hollow cone of diameter d and height h lies at a vertical distance of _____ from the base.

- A. $\frac{h}{2}$
- B. $\frac{h}{3}$
- C. $\frac{h}{4}$
- D. $\frac{h}{6}$

Answer ||| B

Solution |||

Centre of gravity of a uniform hollow cone



$$dm = \frac{M}{\pi R \sqrt{R^2 + H^2}} \times 2\pi x \sin \theta \cdot dx$$

$$dm = \frac{M}{R \sqrt{R^2 + H^2}} \times 2x \frac{R}{\sqrt{R^2 + H^2}} \times dx$$

$$dm = \frac{2M}{(H^2 + R^2)} \times x dx$$

We consider a strip ring of mass dm as an element

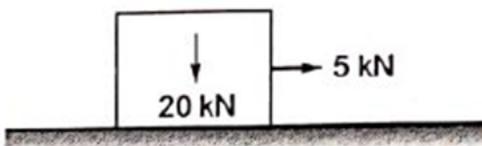
$$\begin{aligned}
 y_c &= \frac{1}{M} \int dm y \\
 &= \frac{1}{M} \int \frac{2M}{(H^2 + R^2)} (x dx) \times \frac{(x)H}{\sqrt{R^2 + H^2}} \\
 &= \frac{2M}{(H^2 + R^2)^{3/2}} \int_0^{\sqrt{R^2 + H^2}} x^2 dx \\
 &= \frac{2H}{(H^2 + R^2)^{3/2}} \left(\frac{x^3}{3} \right)_0^{\sqrt{R^2 + H^2}} \\
 y_c &= \frac{2H}{3} \times \frac{(\sqrt{R^2 + H^2})^3}{(H^2 + R^2)^{3/2}} = \frac{2H}{3} \\
 y_c &= \frac{H}{3} \text{ from the base}
 \end{aligned}$$

2. A block of weight 20 kN just begins to move along a horizontal surface on application of 5 kN horizontal force. The coefficient of friction between block and surface is:

- A. 0.10
- B. 0.20
- C. 0.25
- D. 0.50

Answer ||| C

Solution |||



$$f = \mu N$$

$$f = \mu N = 5 \text{ kN}$$

$$\mu \times 20 = 5$$

$$\mu = \frac{5}{20} = 0.25$$

3. The ratio of modulus of rigidity to modulus of elasticity for a Poisson's ratio of 0.25 would be:

- A. 0.4
- B. 0.5
- C. 0.2
- D. 0.1

Answer ||| A

Solution |||

$$E = 2G(1 + \nu)$$

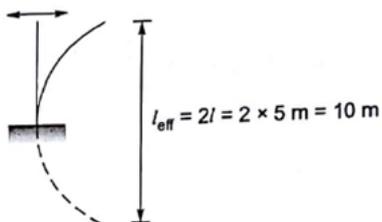
$$G/E = 1 / \{2(1 + 0.25)\} = 0.4$$

4. A electric pole 5 m high is fixed into the foundation. It carries a wire at the top and is free to move sideways. The effective length of the pole is

- A. 3.25 m
- B. 4 m
- C. 5 m
- D. 10 m

Answer ||| D

Solution |||



5. The Poisson's ratio of a material is 0.3 and Young's modulus is 200 GPa. Its Rigidity Modulus is:

- A. 77 GPa
- B. 51 GPa
- C. 125 GPa
- D. 333 GPa

Answer ||| A

Solution |||

$$G = \frac{E}{2(1 + \mu)} = \frac{200 \text{ GPa}}{2(1 + 0.3)}$$

= 77 GPa

6. A truss containing 'j' joints and 'm' members, will be a simple truss if

- A. $j = 2m - 3$
- B. $m = 2j - 3$
- C. $m = 3j - 2$
- D. $j = 3m - 2$

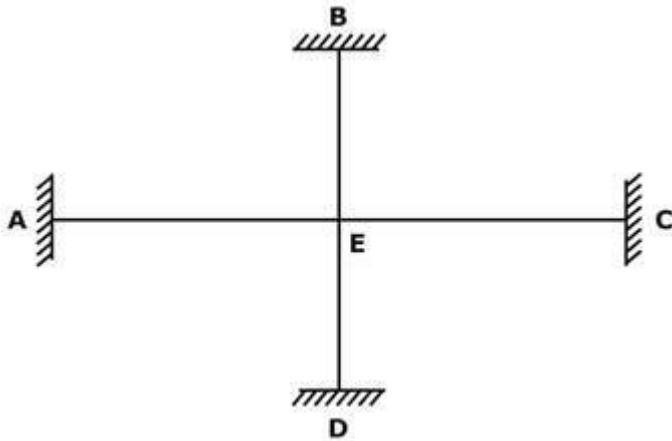
Answer ||| B

Solution ||| If $m = 2j - r$ = Determinate Truss

If $m > 2j - r$ = Indeterminate Truss

If $m < 2j - r$ = Unstable Truss

7. Four identical beams AE, BE, CE and DE have been rigidly jointed at E as shown in the figure below. The point C slips and rotates along with member firmly fixed at E.



Which of the following is correct?

- A. There is no moment on the members
- B. Except at C, there is no moment on the members of frame
- C. Except at C and E for member EC, no moment will be there on other members
- D. All the members are subjected to moment

Answer ||| D

Solution |||

Since the members are finally fixed at E and E is a rigid joint at which all the members will have same rotation. So from slope deflection equations, all the members will have the moment.

8. Degree of static indeterminacy of a rigid jointed plane frame having 15 members, 3 reaction components and 14 joints is

- A. 2
- B. 3
- C. 6
- D. 8

Answer ||| C

Solution |||

$$D_s = 3m + r - 3j$$

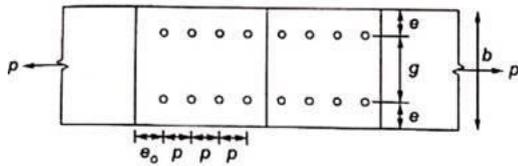
$$= 3 \times 15 + 3 - 3 \times 14 = 6$$

9. Gauge of bolt is the distance between two consecutive bolts in

- A. the direction perpendicular to the direction of load/stress
- B. the direction of load/stress
- C. the direction at 45° to the line of action of force
- D. an inclined direction

Answer ||| A

Solution |||



e = edge distance, p = pitch

e_0 = end distance, g = gauge

10. Two angles ISA $60 \times 60 \times 5$ are welded with gusset plate back to back. The size of the weld is 4.5 mm. The effective throat thickness is

- A. 3.15 mm
- B. 4.5 mm
- C. 4.0 mm
- D. 35 mm

Answer ||| A

Solution ||| $t = ks$

$k = 0.7$ for $60^\circ - 90^\circ$

$s = 7.5$

$t = 0.7 \times 4.5 = 3.15$ mm

11. For a circular slab carrying a uniformly distributed load, the ratio of the maximum negative to maximum positive radial moment is

- A. 1
- B. 2

- C. 3
- D. 4

Answer ||| B

Solution ||| Circular slab with uniformly distributed load,

Radial moment, $M_r = w/16[(3+\mu)(a^2-r^2)]$

For maximum positive B.M, $r = 0$

» M_r , (positive) = $w/16[(3+\mu)a^2]$

For maximum negative B.M, $r^2 = -a^2$

» M_r , (negative) = $w/16[(3+\mu).2a^2]$

So M_r , (negative) / M_r , (positive) = 2.

12. Then tensile strength of concrete to be used in the design of reinforced concrete members is _____.

- A. $0.7 f_{ck}$
- B. $0.1\sqrt{f_{ck}}$
- C. $0.7\sqrt{f_{ck}}$
- D. 0

Answer ||| C

Solution ||| As per IS 456:2000

Then tensile strength of concrete to be used in the design of reinforced concrete members is

$$0.7\sqrt{f_{ck}}$$

Or about to 10% to 15% of compressive strength.

13. Which of the following is true regarding load balancing prestress concrete beam concept

- A. Shape of cable is converted into a straight cable.
- B. Cross-section is subjected to axial stress.
- C. BM and SF do not exist.
- D. All are correct

Answer ||| D

Solution ||| In case of load balancing cross-section is subjected to axial stress only and the tendon profile is converted to straight cable. The section thus deduced is not subjected to any bending moment or shear force.

14. The cable for a prestressed concrete simply supported beam subjected to uniformly distributed load over the entire span should ideally be _____.

- A. placed at the centre of cross section over the entire span
- B. placed at some eccentricity over the entire span
- C. varying linearly from the centre of cross section at the ends to maximum eccentricity at the middle section
- D. parabolic with zero eccentricity at the ends and maximum eccentricity at the centre of the span.

Answer ||| D

Solution ||| parabolic with zero eccentricity at the ends and maximum eccentricity at the centre of the span

The load balancing concept is used to decide the cable profile. The shape of B.M.D forms the basis for cable profile. In the case of udl, the BMD is parabolic so cable profile will also be parabolic.

15. When water is added to cement _____.

- A. heat is generated
- B. heat is absorbed
- C. chemical reaction is initiated
- D. Both heat is generated and chemical reaction is initiated

Answer ||| D

Solution ||| When Portland cement is blended with water, heat will be generated. This heat is named the heat of hydration, and it is the product of the exothermic chemical reaction between cement and water.

16. Plaster of Paris is obtained by calcining _____.

- A. bauxite
- B. gypsum
- C. kankar
- D. lime stone

Answer ||| B

Solution ||| Plaster is made by heating gypsum ($\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$) powder, thus converting it to calcium sulphate hemihydrate ($\text{CaSO}_4 \cdot \frac{1}{2}\text{H}_2\text{O}$). The hemihydrate is also known as stucco or Plaster of Paris

17. To produce impermeable concrete _____.

- A. thorough mixing of concrete is required
- B. proper concentration of concrete is required
- C. proper curing of concrete is required
- D. All options are correct

Answer ||| D

Solution ||| Low permeability concrete is a material with a very low porosity, thus reducing the flow of water through it.

- It can be used in Cisterns, water storage tanks and water Canals.
- Its low permeability helps the water-proofing systems.
- Allows for the recovery of rainwater.
- Reduces the flow of humidity
- Substitutes for waterproofing of walls and foundations.

To produce impermeable concrete, one should do the following

- Proper compaction of concrete
- Thorough mixing of concrete
- Proper curing of concrete
- Use properly graded and non-porous aggregates

18. The term frog means _____.

- A. an apparatus to lift the stone
- B. a depression on a face of brick
- C. vertical joint in a brick work
- D. soaking brick in water

Answer ||| B

Solution ||| Frog of Bricks: The depression provided in the face of brick during its manufacturing is known as frog of bricks.

Depth of a frog in a brick is 10mm to 20 mm.

If the bricks are laid according to British standards, the frog should be laid upward and filled with mortar.

19. Estimate for electrical wiring is prepared on the basis of?

- A. Number of appliances
- B. Voltage
- C. Power
- D. Number of points

Answer ||| D

Solution ||| Electrical wiring is represented in Number of points. The cost of electrification is about 8% of the total estimated cost.

20. When actual cost of construction plus certain profit is paid to the contractor then such a contract is known as _____.

- A. Unscheduled contract
- B. Nominated contract
- C. Cost plus percentage contract
- D. Work order

Answer ||| C

Solution ||| Cost and profit to contractor is defined as percentage contract

21. The load carrying capacity of an individual friction pile is 250 KN. What is the total load carrying capacity of a group of 4 such piles with group efficiency as 0.78?

- A. 780 KN
- B. 1100 KN
- C. 1560 KN
- D. 390 KN

Answer ||| A

Solution |||

Load carrying capacity of pile group = Group efficiency factor x Number of piles x Individual pile capacity

$$= 0.78 \times 4 \times 250$$

= 780 KN

22. A loose uniform sand with rounded grains has effective grain size of 0.05 cm. Co-efficient of permeability of the sand is _____.

- A. 0.25 cm/sec
- B. 0.5 cm/sec
- C. 1 cm/sec
- D. 1.25 cm/sec

Answer ||| A

Solution ||| Coefficient of permeability given by allen-hazen formula $K = CD^2 = 0.25$ cm/sec
Where $c = \text{constant} = 100$
 $D = \text{effective grain size}$

23. Active earth pressure of a soil is defined as the lateral pressure exerted by the soil when

- A. the retaining wall is at rest
- B. the retaining wall tends to move away from the backfill
- C. the retaining wall moves in the soil
- D. none of these

Answer ||| B

Solution ||| A retaining wall when moves away from the backfill, there is a stretching of the soil mass and the active state of earth pressure exists.

24. A sample of saturated clay has a porosity of 0.562. The void ratio of the clay is

- A. 1.283
- B. 0.438
- C. 1.779
- D. 0.360

Answer ||| A

Solution |||
$$e = \frac{0.562}{1 - 0.562} = 1.283$$

25. Approximate ratio of the permeabilities of two clean soils having $D_{10} = 0.6\text{mm}$ and $D_{10} = 0.3\text{mm}$ is:

- A. 4.0
- B. 3.75
- C. 4.25
- D. 3.5

Answer ||| A

Solution |||

As per Allen Hazen's equation, permeability (k) is given as

$$k = CD_{10}^2$$

C = Hazen's constant whose value varies from 100 to 150

D_{10} = effective size in cm

Therefore, K is directly proportional to D_{10}^2

$$\frac{k_{0.6}}{k_{0.3}} = \frac{6^2}{3^2}$$

$$\frac{k_{0.6}}{k_{0.3}} = 4$$

26. Which of the following is not a classification of piles on the basis of installation ?

- A. Driven piles
- B. Bored piles
- C. Screwed piles
- D. steel piles

Answer ||| D

Solution ||| Piles are classified as steel pile on the basis of material of piles.

27. An ideal flow of a liquid obeys:

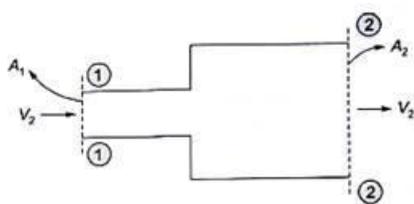
- A. Continuity equation
- B. Newton's law of viscosity
- C. Newton's second law of motion
- D. Dynamic viscosity law

Answer ||| A

Solution ||| An ideal flow of fluid will always satisfy continuity equation.

Continuity equation states that mass entering a control volume = mass exiting from that control volume

i.e. $\rho_1 A_1 V_1 = \rho_2 A_2 V_2$



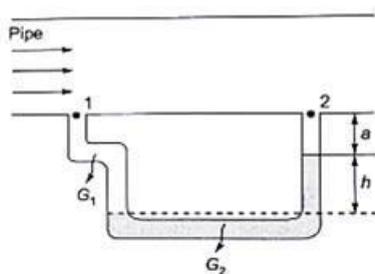
It is based on law of conservation of mass

28. Differential manometers are used to measure:

- A. Pressure in water channels, pipes, etc.
- B. Difference in pressure at two points
- C. Atmospheric pressure
- D. Very low pressure

Answer ||| B

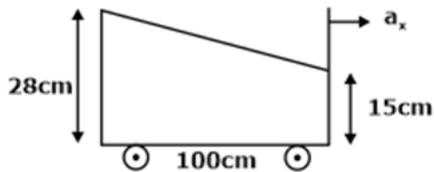
Solution ||| Differential manometer is used to measure pressure difference between two point in a pipe or between two different pipes.



$$P_1 + G_1 \gamma_w (a + h) - G_2 \gamma_w h - G_1 \gamma_w a = P_2$$

$$P_1 - P_2 = (G_2 - G_1) \gamma_w h$$

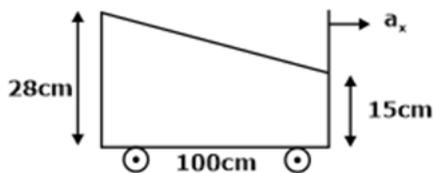
29. The tank of liquid (glycerin at 20°C with its density of 1260 kg/m³) in the adjacent figure, accelerates to the right with the fluid in rigid-body acceleration in m/s² would be



- A. 2.75 m/sec²
- B. 1.28 m/sec²
- C. 1.47 m/sec²
- D. 9.81 m/sec²

Answer ||| B

Solution |||



Using formula

$$\frac{dz}{dx} = \frac{z_2 - z_1}{x_2 - x_1} = \frac{+a_x}{a_2 \pm g}$$

$$\frac{28 - 15}{100 - 0} = \frac{+a_x}{0 + 9.81}$$

$$a_x = 1.275$$

$$a_x = 1.28 \text{ m/sec}^2$$

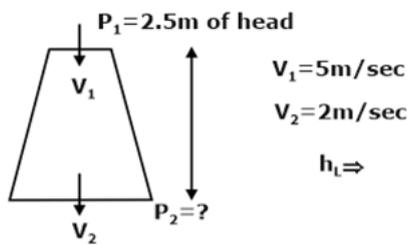
Option (B) is correct.

30. A conical tube of length 2m is fixed vertically with its smaller end upwards. The velocity of the flow at the smaller end is 5m/s while at the lower end it is 2m/s. The pressure head at the smaller end is 2.5m of liquid. The loss of head in the tube is $\frac{0.35(V_1 - V_2)^2}{2g}$. What will be the pressure head at the lower end if the flow occurs in the downward direction?

- A. 13.427m of fluid
- B. 5.407 m of fluid
- C. 18.337 m of fluid
- D. 8.325 m of fluid

Answer ||| B

Solution |||



$$\frac{p_1}{\rho g} + \frac{v_1^2}{2g} + z_1 = \frac{p_2}{\rho g} + \frac{v_2^2}{2g} + z_2 + h_L$$

$$2.5 + \frac{(5)^2}{2 \times 9.81} + 2 = \frac{p_2}{Pg} + \frac{(2)^2}{2 \times 9.81} + 0 + \frac{0.35 / 5 - 2}{2 \times 9.81}$$

$$\frac{P_2}{Pg} = 5.407 \text{ m of fluid.}$$

31. A sudden change in the flow velocity or pressure created in water pipe line due to sudden closure of valve is called

- A. Boiling
- B. Implosion
- C. Vibration
- D. Water hammer

Answer ||| D

Solution |||

The pressure force acted due to wave generated when a valve is suddenly closed is known as water hammer.

32. Sharper crest of an ogee spillway

- A. Increases the value of coefficient of discharge
- B. Decreases the effective head
- C. Increases stability of crest due to hydrostatic pressure
- D. Has no effect on any one of the above

Answer ||| A

Solution |||

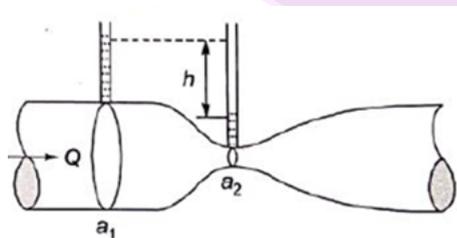
Sharper crest of an ogee spillway reduces the frictional resistance and hence coefficient of discharge is increased .

33. Water flow in large sized pipes for large flow rates can be measured using:

- A. Orifices
- B. Notches
- C. Venturimeter
- D. Elbow meter

Answer ||| C

Solution |||



$$Q = \frac{C_d a_1 a_2 \sqrt{2gh}}{\sqrt{a_1^2 + a_2^2}}$$

Venture meter is used to measure flow rate in pipes.

34. Small hydroelectric project generates power

- A. <25MW
- B. <100 MW
- C. <550 MW
- D. <1000 MV

Answer ||| A

Solution |||

Small hydroelectric project: <25 MW

Medium hydroelectric project: <25-100 MW

Heavy hydroelectric project: >100 MW

35. The ratio of the peak load to the installed capacity of the plant is known as

- A. Load factor
- B. Plant factor
- C. Utilization factor
- D. All the options are correct

Answer ||| C

Solution |||

- Load factor is defined as the total load divided by the peak load in a specified time period.
- Plant capacity factor is the ratio of actual energy produced to the maximum possible energy that could have been produced during a given period.
- Utilization factor is defined as the ratio of maximum demand on power station to the installed capacity of the plant.

36. W-index will be always

- A. Equal to ϕ -index
- B. More than ϕ -index
- C. Less than ϕ -index

D. A constant fraction of ϕ -index

Answer ||| C

Solution |||

W index also considers the losses, which are not included in the ϕ -index calculation.

$$\phi \text{ index} = \frac{P - R}{t}$$

$$W \text{ index} = \frac{P - R - \text{losses}}{t}$$

Hence W index is always less than ϕ index.

37. For a synthetic unit hydrograph, the width of the unit hydrograph at 50% peak discharge is 87.5 h then the width of unit hydrograph in h at 75% peak discharge would be

- A. 10
- B. 30
- C. 50
- D. 100

Answer ||| C

Solution |||

From SUN formulas,

$$\frac{W_{75}}{W_{50}} = \frac{1}{1.75}$$

$$W_{75} = \frac{87.5}{1.75} = 50 \text{ m}^3 / \text{s}$$

38. The most accurate method of finding the average depth of rainfall over an area is

- A. Isohyetal method
- B. Arithmetic mean method
- C. Thiessen polygon method
- D. All of these

Answer ||| A

Solution |||

According for finding average depth by various methods follows the order:

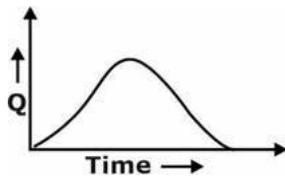
Arithmetic mean method < Thiessen polygon method < Isohyetal method

39. The shape of recession limb of a hydrograph depends upon

- A. Basin characteristics only
- B. Storm characteristics only
- C. Both basin characteristics and storm characteristics
- D. None of these

Answer ||| A

Solution |||



Rising limb shape depends on storm and basin characteristics both but the recession limb starts after the storm has ended and hence it depends on basin characteristics only.

40. For nine number rain gauge stations with an error of 10% in the estimation of mean of the rainfall, the coefficient of variation of rainfall C_v obtained as:-

- A. 10
- B. 20
- C. 30
- D. 40

Answer ||| C

Solution |||

$$N = \left(\frac{C_v}{\varepsilon} \right)^2$$

$$\Rightarrow 9 = \left(\frac{C_v}{10}\right)^2$$

$$\Rightarrow C_v = 3 \times 10 = 30\%$$

41. The quantity of water retained by subsoil against pull of gravity is known as:-

- A. yield
- B. specific retention
- C. porosity
- D. specific yield

Answer ||| B

Solution |||

Quantity of water retained by subsoil against pull of gravity is known as specific retention.

42. The area in which crop is grown at a particular time or crop season is called

- A. culturable cultivated area
- B. Gross commanded area
- C. culturable commanded area
- D. None of these

Answer ||| A

Solution |||

Culturable command area (CCA) → It is the area on which crop can be grown satisfactorily. CCA is further be into two categories.

Culturable cultivated area: - It is the area in which crop is grown at a particular time or crop season.

Culturable uncultivated area: - It is the area in which crop is not sown in a particular season.

Gross command area: - is the total area that can be economically irrigated from an irrigation scheme without considering the limitations of water.

43. The average delta for a sugarcane crop is nearer to

- A. 400 mm
- B. 800 mm
- C. 1200 mm
- D. 1600 mm

Answer ||| C

Solution |||

Average approximate value of delta (Δ) for a certain important crops are-

Rice	Δ (cm) on field
Sugarcane	120 cm
Rice	120
Cotton	50
Wheat	40
Maize	25

44. The average delta for a sugarcane crop is nearer to

- A. 400 mm
- B. 800 mm
- C. 1200 mm
- D. 1600 mm

Answer ||| C

Solution |||

Average approximate value of delta (Δ) for a certain important crops are-

Rice	Δ (cm) on field
Sugarcane	120 cm
Rice	120
Cotton	50
Wheat	40
Maize	25

45. The maximum scour depth (d_{\max}) for condition of flow at noses of piers is

- A. 1.5 d
- B. 1.75 d
- C. 2.0 d
- D. 2.75 d

Answer ||| C

Solution |||

Lacey's formula for normal scouring depth in alluvial streams $d_{\max} = k \cdot d$

Where,

d = normal scouring depth

K = a const. It varies according to the type of river flow

$K = 1.27$ for straight reach

$K = 1.50$ for moderate bend

$K = 1.75$ for sharp/severe bend

$K = 2.0$ for 90° bend and at the noses of piers

$K = 2.75$ for upstream noses of guide banks

46. Small hydroelectric project generates power

- A. <25 MW
- B. <100 MW
- C. <550 MW
- D. <1000 MW

Answer ||| A

Solution |||

Small hydroelectric project: <25 kW

Medium hydroelectric project: <25-100 kW

Heavy hydroelectric project: >100 kW

47. Pick up the correct sequence of the parts of a canal system

- A. Main canal-distributary-branch canal-head works-minor
- B. Head works-main canal-branch canal-distributary-minor
- C. Head works-main canal-branch canal-minor-distributary
- D. Head works-branch canal-main canal-distributary-minor

Answer ||| B

Solution |||

Main canal runs out from canal head works and branches into branch canal with further bifurcation into distributaries and finally into minors.

48. Which of the following is not a hill road classification as per The Border Roads Organisation?

- A. Class 6
- B. Class 5
- C. Class 3
- D. National highway

Answer ||| A

Solution |||

The border roads organization has classified hill roads as below:

- a. National highways
- b. Class 9
- c. Class 5
- d. Class 3

49. Pick up the correct statement from the following

- A. Construction joints are necessarily planned for their locations
- B. Expansion joints are provided to accommodate thermal expansion
- C. Contraction joints are provided to control shrinkage cracks

D. All option are correct

Answer ||| D

Solution ||| All option are correct.

50.The absolute minimum radius of curve for safe operation, for a speed of 110 kmph is:

- A. 110 m
- B. 440 m
- C. 220 m
- D. 577 m

Answer ||| B

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

Solution |||

e=0.07, f=0.15, V=110Km/hr
R= 433m

51.The VDF of a lane if the CVPD is greater than 1500 in plain terrain is?

- A. 4.5
- B. 2.5
- C. 3.0
- D. 4.0

Answer ||| A

Solution |||

The VDF in plain terrain is 4.5 if the CVPD is greater than 1500. It mainly depends on the commercial vehicle and terrain

52. The shear failure of soil sub grade may be attributed to?

- A. Inadequate stability
- B. Excessive stress
- C. Inadequate stability & Excessive stress
- D. none of the mentioned

Answer ||| C

Solution |||

The failure of sub grade in shear may be attributed to inadequate stability and excessive stress application.

53. The main cause of inadequate stability of bitumen mix doesn't include

- A. Improper gradation of aggregate
- B. Use of wrong viscosity grade of bitumen
- C. Poor quality check
- D. more stopping sight distance provided

Answer ||| D

Solution |||

The stopping sight distance is not a property of the bitumen mix; it is a geometric design property.

54. In a bitumen pavement, fatigue causing from repeated stress applicant cracking is type of?

- A. longitudinal cracking
- B. Block cracking
- C. Edge cracking
- D. Alligator cracking

Answer ||| D

Solution ||| 1. Cracking, which is developed due to repeated loader fatigue is called as fatigue or alligator cracking.

2. If there is giant rectangular or square shape crack pavement is occurred, it is called as block cracking.

3. Edge crack appear at the very edge next to the curb as a result of unstable drainage and lacteal support.

4. Longitudinal cracking in asphalt is typically signifier of joint structure of traffic lanes that are next to earth other.

55.If the average centre to centre spacing of vehicle is 25 meters, then the basic capacity the traffic lane at a speed of 80kmph is,

- A. 3200 vehicle /day
- B. 2500 vehicle /day
- C. 3200 vehicle /hour
- D. 3120 vehicle /hour

Answer ||| C

Solution ||| Basic capacity

$$C = \frac{1000V}{S}$$

Where, v, avg. speed (in kmph) = 80 kmph

And S = centre to centre spacing of vehicle = 25 m

So, Basic capacity,

$$C = \frac{1000 \times 80}{25}$$

C = 3200 vehicle/hours.

56. The number of intersections at the traffic rotary can be possible,

- A. 1 to 4
- B. 2 to 5
- C. 3 to 6
- D. 4 to 7

Answer ||| D

Solution ||| Number of intersecting roads is between 4 and 7 in a traffic rotary.

57. Equivalent factor for PCU for a Horse drawn vehicle as per IRC is,

- A. 1.0
- B. 2.0
- C. 3.0
- D. 4.0

Answer ||| D

Solution ||| For the study of mixed traffic flow, in common practice, passenger car is considered as standard vehicle unit is called passenger car unit or PCU.

Tentative Equivalent factors suggested by IRC,

Vehicle Class	Equivalent factor
i) Passenger car, tempo, auto rickshaw, tractor	1.0
ii) Motor cycle, scooter, Paddle cycle	0.5
iii) Horse drawn vehicle	4.0

58. Most efficient and comfortable parking along kerb with

- A. 90° angle parking
- B. 45° angle parking
- C. 30° angle parking
- D. 60° angle parking

Answer ||| B

Solution ||| → Maximum number of vehicle can be parked with 90° with kerb.

→ Most comfortable parking is at 45° with kerbs.

59. Which of the following is correct regarding 'STOP' sign?

- A. It is hexagonal shape, white boundary and Red background.
- B. It is of octagonal shape, white boundary and red background.
- C. It is of hexagonal shape, red boundary and white background.
- D. It is of octagonal shape, Red boundary and white background.

Answer ||| B

Solution |||

60. In Plane tabling failure of fix occurs when

- A. The plane table is inside the great triangle.
- B. The plane table is inside the great circle.
- C. The plane table is outside the great circle.
- D. The plane table is on the great circle.

Answer ||| D

Solution |||

When the position of plane table lies on or near the great circle the station of three-point problem becomes indeterminate, hence failure of fix occurs.

When position of plane table is inside the great triangle or outside the great triangle Lehmann's rule are used to estimate location of plane table.

61. As per IS, the length of one link in a 30 m chain should be

- A. 20 cm
- B. 30 cm
- C. 40 cm

D. 100 cm

Answer ||| A

Solution |||

The 30 m chain is divided into 150 links, so link is of 0.2 m

62. If the image of a triangulation station of R.L. 500 m is 4 cm from the principal point of a vertical photo taken from an altitude of 2000 m above the datum, the height of displacement will be

A. 6 mm

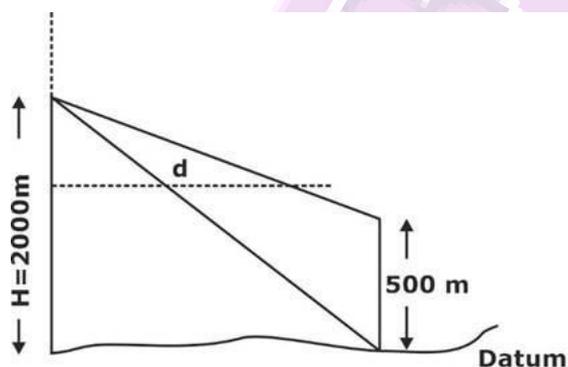
B. 8 mm

C. 10 mm

D. 12 mm

Answer ||| C

Solution |||



$$d = \frac{r \cdot h_1}{H - h}$$

d = relief displacement

r = distance of image of top of tower from vertical axis.

$h_1 = \text{ht of tower station}$

$h = \text{avg ht tower above datum}$

Hence
$$d = \frac{4 \times 10^{-2} * 500}{2000} = 10^{-2} \text{m} = 10 \text{mm}$$

63. If the length of chain is 20 m, the degree of curve is given by

- A. 1146/R
- B. 1546/R
- C. 1519/R
- D. 1119/R

Answer ||| A

Solution |||

where R is radius of circular curve.

For 20 m chain length

$$D = \frac{1146}{R}$$

For 30 m chain length

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

64. In plane table the instrument used to measure horizontal and vertical distances directly is known as

- A. Simple alidade
- B. Telescopic alidade

C. Tacheometer

D. Clinometer

Answer ||| B

Solution |||

A telescopic alidade is used to measure horizontal and vertical distance in plane table surveyings

Note: - Clinometer is used to measure slope of the ground and tachometer also measured horizontal and vertical distance but is not part of plane table surveying.

65. Perpendicular offset from a tangent to the junction of a transition curve and circular curve is equal to

A. S

B. $2 S$

C. $3 S$

D. $4 S$ where ' S ' is shift.

Answer ||| D

Solution |||

The offset for the transition curve are found from

$$y = \frac{x^3}{6RL}$$

Where x = measured length along the curve (m)

R = Radius of curve (m)

L = Length of curve (m)

Hence for $x = L$

$$y = \frac{L^2}{6R} = 4S \quad \text{here} \quad S = \text{shift} = \frac{L^2}{24R}$$

66. In aerial vertical photography, the longitudinal overlap is normally kept as

- A. 50%
- B. 60%
- C. 70%
- D. 75%

Answer ||| B

Solution |||

In aerial photography, the longitudinal overlap is generally 60% and side overlap is 30%.

67. During which of the following operating conditions of an automobile is carbon monoxide content in the exhaust gas the minimum?

- A. Idle running
- B. Acceleration
- C. Cruising
- D. Deceleration

Answer ||| A

Solution |||

During idle running carbon monoxide level in the exhaust gas is minimum.

68. Which of the following units is employed for the removal of particulate matter below 1 micron (μm) in size?

- A. Fabric filters
- B. Cyclone
- C. Electrostatic precipitator

D. Gravity settling chamber

Answer ||| C

Solution |||

For Particulate matter of less than 1 micron in size electrostatic precipitators are used

69. Ball valve is used:

- A. For isolating
- B. For reversal of flow
- C. For maintaining constant level of water
- D. None of these

Answer ||| C

Solution |||

Ball valve is used For maintaining constant level of water

70. Ground water contaminated with TCE is treated with powdered activated carbon by adsorption (isotherm : $Q_{eq} = 129(C_{eq})^{0.73}$ where Q_{eq} is mass of TCE adsorbed on PAC (mg/mg PAC); C_{eq} is concentration of dissolved TCE in water (mg/L)). If TCE concentration in water is 1 mg/L, what mass concentration of PAC must be used (mg PAC/L water) to reduce TCE concentration to 0.005 mg/L?

- A. 0.3690 mg/L
- B. 0.45 mg/L
- C. 0.35 mg/L
- D. 0.40 mg/L

Answer ||| A

Solution |||

Required $C_{eq} = 0.005$ mg/L

Q_{eq} required for $C_{eq} = 0.005$ mg/L

$$\Rightarrow Q_{eq} = 129(0.005)^{0.73}$$

$$Q_{eq} = 2.6967$$

$$Q_{eq} = \frac{\text{Mass of TCE absorbed}}{\text{Mass of PAL}}$$

$$= \frac{1\text{mg} - 0.005\text{mg}}{x\text{mg} / L} = 2.6967$$

$$x = \frac{0.995}{2.6967} \text{mg} / L = 0.369\text{mg} / L$$

71. An experiment shows that a concentration of 0.1 mg/L of HOCl yield an 89% killed of bacteria in 5 minutes. Calculate disinfection rate constant. Assume that Chick's Law and Watson's Law hold.

- A. 0.3/min
- B. 0.366/min
- C. 0.4416/min
- D. 0.40/min

Answer ||| C

Solution |||

89% killing means 11% are left

$$N_t = 0.11 N_o$$

$$\frac{N_t}{N_o} = e^{-kit}$$

$$= e^{-k \times 5} = 0.7408$$

$$K = \frac{-\ln(0.11)}{5_o} = 0.4416/\text{min}$$

72. For the following information (Equation of isotherm of Anthracene on alumina: $Q = \frac{22C_t}{1+35C_t}$ where Q is 0.1 mol Anthracene/kg alumina; $C_t = 0.0054$ mol Anthracene/L Liquid), calculate remaining Anthracene concentration (mol/L) for 0.1 mol/kg adsorption capacity?

- A. 0.00054 mol/L
- B. 0.0054 mol/L

- C. 0.02 mol/L
- D. 0.054 mol/L

Answer ||| B

Solution |||

$$Q = \frac{22C_t}{1+35C_t}$$

Given $Q = 0.1$ mol Anthracene/kg alumina

$C_t = ?$

$$0.1 = \frac{22C_t}{1+35C_t}$$

$$\Rightarrow 0.1 = 18.5 C_t$$

$C_t = 0.0054$ mol/L

73. Which of the following is the approximate triaxial test to assess the immediate stability of an unloading problem, such as an excavation of a clay slope?

- A. CU Test
- B. CD Test
- C. UU Test
- D. None

Answer ||| A

Solution |||

For loading condition

Immediate stability is attained by UU Test

Immediate settlement is attained by CU Test

For unloading condition

Immediate stability is attained by CU Test.

As in CU Test consolidation process takes time to complete. So while unloading if we perform the CU test, we can immediately perform the test for obtaining immediate settlement.

74. Moist soil has a degree of saturation between.

- A. 0 to 0.25
- B. 0.25 – 0.5
- C. 0.5 – 0.75
- D. > 0.75

Answer ||| C

Solution |||

$$\text{Degree of saturation} = \frac{V_w}{V_v} = \frac{\text{Volume of water in the soil}}{\text{Volume of voids of the given soil}}$$

Degree of Saturation	Soil Type
0 – 0.25	Humid
0.25 – 0.5	Damp
0.5 – 0.75	Moist
0.75 – 1.0	Wet

75. The liquid limit and plastic limit of a sample are 64% and 28% respectively. The % of the soil fraction with grain size finer than 0.002 mm is 24. The activity of the soil sample is

- A. in active
- B. normal active
- C. active
- D. none

Answer ||| C

Solution |||

$$\text{Activity} = \frac{I_p(W_L - W_p)}{\% \text{by weight of clay fraction}}$$

$$= \frac{64 - 28}{24} = \frac{36}{24} = \frac{3}{2} = 1.5$$

Activity	State
<0.75	In active
0.75 - 1.25	Normal
>1.25	Active

