

1. Two beams carrying identical loads, simply supported, are having same depth but beam A has doubled the width as compared to beam B. The ratio of the strength of beam A to that of beam B is:

- A. 4
- B. 1
- C. 2
- D. 6

Answer ||| C

Solution |||

Width of beam A is twice of beam B. Strength is directly proportional to elastic section modulus i.e  $Z=bd^2/6$ ,

Thus  $Z_A= 2bd^2/6$ ,  $Z_B= bd^2/6$   $Z_A/ Z_B=2$

2. A prismatic bar with rectangular cross-section  $20 \times 40$  mm, length = 2.8 m is subjected to axial tension force of 70 kN. The measured elongation of bar is 1.2 mm. What will be the strain ?

- A.  $428 \times 10^{-6}$
- B.  $400 \times 10^{-6}$
- C.  $450 \times 10^{-6}$
- D. None of these

Answer ||| A

Solution |||  $\Delta = \frac{PL}{AE} = \frac{70 \times 10^3 \times 2.8 \times 10^3}{20 \times 40 \times E}$ , Strain =  $\frac{12mm}{2.8 \times 10^3 mm} = 4.28 \times 10^{-4}$

3. The slenderness ratio of a vertical column of square cross-section of 2.5 cm sides and 300 cm effective length, is

- A. 200
- B. 360
- C. 240
- D. 416

Answer ||| D

Solution |||

$$A = \frac{l_{eff}}{r_{min}} = \frac{300cm}{\sqrt{\frac{(2.5)^4}{12} \times \frac{1}{(2.5)^2}}}$$

$$r_{min} = \sqrt{\frac{I}{A}} = 415.69$$

4. The Euler's crippling load for a 2m long slender steel rod of uniform cross-section hinged at both the ends is 1 kN. The Euler's crippling load for a long steel rod of the same cross-section and fixed at both the ends will be

- A. 0.25kN
- B. 0.5 kN
- C. 2 kN
- D. 4 kN

Answer ||| D

Solution |||

$$P_1 = \frac{\pi^2 EI}{l^2}$$

$$P_1 \alpha = \frac{1}{l^2}$$

$$P_{12} = P_{11} \times \frac{l_1^2}{l_2^2}$$

Case (1)  $l_{eff}=2m$

$P_1=1$  kN

Case (2)  $l_{eff}=1m$

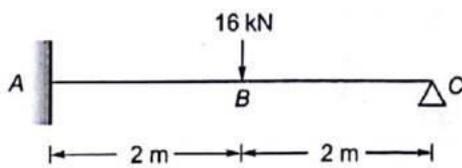
$$P_1 = 1 \times \frac{2^2}{1^2} = 4 \text{ kN}$$

5. A propped cantilever is subjected to a concentrated load of 16 kN at the centre of the span. The length of beam is 4m. The flexural rigidity  $EI=4 \times 10^2 \text{ kNm}^2$ . The reactions at the fixed end and simply supported end are:

- A. 9.87 kN at fixed end and 6.13 kN at simply supported end
- B. 8 kN each at fixed end and simply supported end
- C. 11 kN at fixed end and 5 kN at simply supported end
- D. 16 kN at fixed end and zero kN at simply supported end

Answer ||| C

Solution |||



Using compatibility equation

$$\delta_{\text{due to } 16 \text{ kN load}} + \delta_{R_C} = 0$$

$$\frac{16 \times (2)^3}{3EI} + \frac{16 \times 2^2}{2EI} \times 2 - \frac{R_C \times (4)^3}{3EI} = 0$$

$$\frac{16 \times 8}{3} + 64 = \frac{R_C \times 64}{3}$$

$$R_C = 5 \text{ kN}$$

$$\text{Now } \sum V = 0$$

$$\Rightarrow R_A + R_C = 16 \text{ kN}$$

$$R_A = 16 - 5 = 11 \text{ kN}$$

6. Lamé's equations are applicable for

- A. Thick cylinder
- B. Thin cylinder
- C. Thin spherical vessel

D. Beams

Answer ||| A

Solution |||

Lame's equation is applicable for thick cylinder.

7. In terms of bulk modulus (K) and modulus of rigidity (C), the Poisson's ratio can be expressed as

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

Answer ||| C

Solution |||

Relation between bulk modulus (K) and Modulus of elasticity E

$$E = 3K (1 - 2\mu) \dots(i)$$

Relation between modulus of rigidity (C) and modulus of elasticity (E)

$$E = 2C (1 + \mu) \dots(ii)$$

By equating equation (i) & (ii)

$$\mu = \frac{3K - 2C}{6K + 2C}$$

8. A ductile structure is defined as one for which the plastic deformation before fracture

- A. is smaller than the elastic deformation
- B. vanishes

- C. is equal to the elastic deformation
- D. is much larger than elastic deformation

Answer ||| D

Solution |||

Ductile structure has plastic deformation larger than elastic deformation.

9. Maximum slenderness ratio for tension members shall **not** exceed

- A. 180
- B. 300
- C. 350
- D. 400

Answer ||| D

Solution |||

**Concept:** As per IS 800: 2007, maximum slenderness ratio for tension members shall not exceed 400.

As per IS 800: 2007.

Maximum slenderness ratio for Tension members.

1. A tension member in which reversal of stress due to loads other than wind or seismic loads — 180
2. A member normally acting as a tie in roof truss or a bracing system but subjected to reversal of stresses resulting from the action of wind or earthquake forces — 180
3. Tension members (other than pre-tensioned member) — 400

10. Rolled steel I-sections are most commonly used as beams because they provide

- A. Greater lateral stability
- B. Large moment of resistance as compared to other sections
- C. Large MI with less C/S area
- D. All of the above

Answer ||| D

Solution |||

Advantage of using rolled steel I-section as beam

1. Greater lateral stability.
2. Rolled I-section has large moment of resistance as compared to other section.
3. Large moment of inertia with less C/S area.

So, rolled – steel I-section are most commonly used as beam.

11.If the dimension and grade of concrete of a beam are restricted then it can be designed as which of the following beams?

- A. Doubly reinforced
- B. Balanced
- C. T-beam
- D. L – beam

Answer ||| A

Solution |||

When moment of resistance required is high and both depth and width are restricted, then we generally provide doubly reinforced beam.

12.As per IS 456: 2000, the thickness of reinforced concrete footings on soils at its edge shall not be less than: -

- A. 50 mm
- B. 100 mm
- C. 150 mm
- D. 300 mm

Answer ||| C

Solution |||

As per IS 456: 2000 clause 34.12

Thickness at edge of footing: -

In reinforced and plain concrete footing, the thickness at the edge shall be not less than 150 mm for footing on soil, nor less than 300 mm above the tops of piles per footing on piles.

13. As per the IS 456, the minimum area of temperature reinforcement in either direction of slab, when high yield strength bars are used is \_\_\_\_\_ of gross cross-sectional area.

- A. 0.12%
- B. 0.15%
- C. 0.18%
- D. 0.20%

Answer ||| A

Solution |||

As per IS 456: 2000, the limit of minimum reinforcement along either direction has been specified.

- For mild steel, 0.15% of the gross area
- For HYSD bars, 0.12% of the gross area

high yield strength bars means HYSD bars; hence answer should be A

14. For the reinforcing bars in compression, the values of bond stress for bars in tension shall be .....

- A. increased by 25%
- B. decreased by 25%
- C. increased by 12%
- D. decreased by 12%

Answer ||| A

Solution |||

As per IS 456: 2000

- The value of bond stress is increased by 60% when deformed bars are used
- The value of bond stress is increased by 25% when the bar is in compression.

15. As per IS 456: 2000, the minimum grade of concrete to be used for plain concrete and reinforced concrete, respectively, in concrete works exposed directly along the sea coast are:

- A. M20 and M30
- B. M25 and M40
- C. M15 and M25
- D. M20 and M25

Answer ||| A

Solution |||

Environment	Exposure condition
Mild	Concrete surfaces protected against weather or aggressive conditions, except those situated in coastal area
Moderate	Concrete surfaces sheltered from rain or freezing whilst wet Concrete exposed to condensation and rain Concrete continuously under water Concrete in contact or buried under non-aggressive soil/ground water Concrete surfaces sheltered from saturated salt air in coastal area
Severe	Concrete surface exposed to severe rain, alternate wetting and drying or occasional freezing whilst wet or severe condensation. Concrete completely immersed in sea water. Concrete exposed to coastal environment
Very severe	Concrete surfaces exposed to sea water spray, corrosive fumes or severe freezing conditions whilst wet Concrete in contact or buried under aggressive subsoil ground water
Extreme	Surface of members in tidal zone. Members in direct contact with liquid/solid aggressive chemicals

As per question condition is severe.

Exposure	Minimum grade of concrete	
	PCC	RCC
Mild	-	M20
Moderate	M15	M25
Severe	M20	M30
Very Severe	M20	M35
Extreme	M25	M40

16. Pigment Volume Concentration (PVC) of paint is defined as:

- A.  $\frac{\text{volume of pigment in paint}}{\text{total volume of volatile constituents of paint}}$
- B.  $\frac{\text{volume of pigment in paint}}{\text{total volume of non volatile constituents of paint}}$

- C.  $\frac{\text{volume base in paint}}{\text{total volume of non volatile constituents of paint}}$
- D.  $\frac{\text{volume of vehicle in paint}}{\text{total volume of non volatile constituents of paint}}$

Answer ||| B

Solution |||

$$\text{PVCN} = \frac{\text{volume of pigment in paint}}{\text{total volume of non volatile constituents of paint}}$$

17. The ability of a material to endure alternate wet and dry conditions for a long period without considerable deformation and loss of mechanical strength is called:

- A. fire resistance
- B. Weathering resistance
- C. chemical resistance
- D. frost resistance

Answer ||| B

Solution |||

The ability of a material to endure alternate wet and dry conditions for a long period without considerable deformation and loss of mechanical strength is called . Weathering resistance

18. What is the approximate composition of silicon dioxide (SiO<sub>2</sub>) present in ordinary Portland cement?

- A. 60-67%
- B. 3-8%
- C. 40-50%
- D. 17-25%

Answer ||| D

Solution |||

In OPC :

CaO : 60 – 65%

SiO<sub>2</sub> : 17 – 25%

Al<sub>2</sub>O<sub>3</sub> : 3 – 8%

Fe<sub>2</sub>O<sub>3</sub> : 0.5 – 6%

19. Which of the following statements is true?

- A) Mud plastering does not require curing
- B) Mud plastering requires curing.
- C) It depends on the situation
- A. Only A
- B. Only B
- C. Only C
- D. None of these

Answer ||| A

Solution |||

In mud plastering, after 2 coats of plastering, a wash of earth, cow dung and cement in 3:2:1 proportion is done. It does not require curing, but should be allowed to dry in shade for 3-4 days.

20. What is the amount of water used to conduct the initial setting time test of cement which has a standard consistency of P.

- A. 0.55 P
- B. 0.85 P
- C. 0.60 P
- D. 0.95 P

Answer ||| B

Solution |||

Initial setting time is defined as the time that is measured from the instant, water is added into the cement up to the time it starts losing its plasticity. In order to perform this test, 50 gms of cement sample is taken and gauged with **0.85P** (85% water required to prepare the cement paste of standard consistency is added in it) and the paste prepared is filled in the mould.

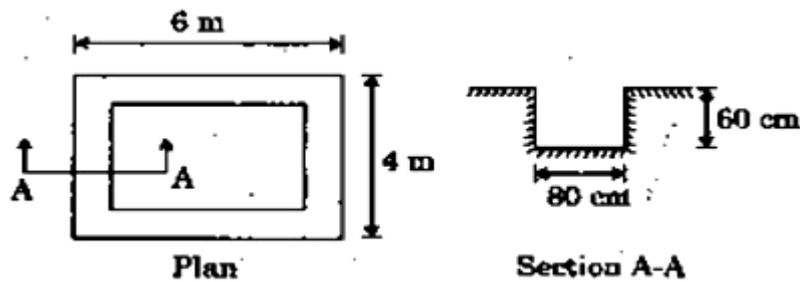
21. The internal angle of friction of a soil is 30 degree. What is the active earth pressure coefficient for the soil mass?

- A. 0.005
- B. 0.025
- C. 0.333
- D. 0.555

Answer ||| C

Solution |||

$$K_a = \frac{1 - \sin \phi}{1 + \sin \phi} = 0.333$$



22.

The above figure represents plan and section of an excavation layout. The volume of earthwork in excavation of foundation trench is

- A. 6.528 cu.m.
- B. 8.064 cu.m.
- C. 8.832 cu.m.
- D. 9.600 cu.m.

Answer ||| B

Solution ||| volume of earthwork in excavation of foundation trench =  $(4+6)*0.8*0.6 + (6-0.8*2)*2*0.8*0.6 = 8.064$  cu.m

23. Cohesion is 15 KN/m<sup>2</sup>, the unit weight of soil is 20 KN/m<sup>3</sup>, the factor of safety is 1.5 and the stability number is 0.05; the safe maximum height of the slope is:

- A. 5 m
- B. 8 m

- C. 10 m
- D. 12 m

Answer ||| C

Solution |||

$$\text{Stability number } N_s = \frac{C_m}{\gamma H}$$

$$C_m = \frac{c}{F.S} = \frac{15}{1.5} = 10 \text{ KN/m}^2$$

$$H = \frac{10}{0.05 \times 20} = 10 \text{ m}$$

24. A concentrated load of 50 tons acts vertically at a point on the soil surface. If Boussinesq's equation is applied for computation of stress, then the ratio of vertical stresses at depths of 2 m and 5 m respectively vertically below the point of application of load will be

- A. 5.75
- B. 6
- C. 6.25
- D. 6.5

Answer ||| C

Solution |||

$$\text{Vertical stress} = \sigma_v$$

$$\text{Depth} = z$$

$$\sigma_v \propto \frac{1}{z^2}$$

$$\frac{\sigma_{v,2 \text{ m}}}{\sigma_{v,5 \text{ m}}} = \frac{5^2}{2^2} = \frac{25}{4} = 6.25$$

25. When a sample of medium sand was tested in a constant head permeameter, if the cross section area of sample is 100 cm<sup>2</sup>, hydraulic gradient is 10 and Discharge collected is 10 cc/sec. Then coefficient of permeability of the sand is

- A. 0.1 m/s
- B. 0.01 m/s
- C. 0.001 m/s
- D. 0.0001 m/s

Answer ||| D

Solution |||

Discharge,  $Q = 10 \text{ cc/sec}$

Hydraulic gradient,  $h = 10$

Area of cross section,  $A = 100 \text{ cm}^2$

Coefficient of permeability,  $k = \frac{Q}{Ah} = \frac{10}{100 \times 10} = 0.01 \text{ cm/sec} = 0.0001 \text{ m/sec}$

26. Soil samples A and B have void ratios of 0.5 and 0.7 respectively. If  $1.5 \text{ m}^3$  of soil sample A and  $1.7 \text{ m}^3$  of soil sample B are mixed to form sample C having a volume of  $3.2 \text{ m}^3$ , which one of the following correctly represents the porosity of sample C?

- A. 0.375
- B. 0.60
- C. 1.66
- D. 2.66

Answer ||| A

Solution |||

The volume of solids  $V_s = \frac{V}{1+e}$  will not change even after mixing

$$\text{Soil A } V_a = \frac{1.5}{1+0.5} = 1 \text{ m}^3$$

$$\text{Soil B } V_b = \frac{1.7}{1+0.7} = 1 \text{ m}^3$$

$$\text{Porosity } n = \frac{V_v}{V}$$

$$\text{Porosity of mix} = \frac{\text{Volume of the voids in the mix}}{\text{Total volume of the mix}}$$

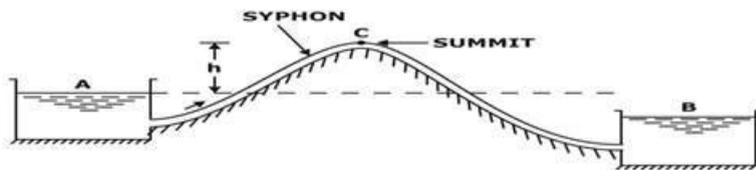
$$n = \frac{3.2-1-1}{3.2} = 0.375$$

27. What is the pressure at the summit of syphon.

- A. 7.6 m
- B. 10.3 m
- C. 2.7 m
- D. 9.1 m

Answer ||| C

Solution |||



Pressure at C is less than the atmospheric pressure.

Theoretically pressure at C is reduced to 10.3 m of water but in actual, this pressure is only 7.6 m of water.

Thus pressure =  $10.3 - 7.6 = 2.7$  m Absolute.

28. In a steady flow of a compressible fluid through a pipe, the density, area and velocity at a particular section are  $1.5 \text{ kg/m}^3$ ,  $1 \text{ m}^2$ , and  $3 \text{ m/s}$ , respectively. At another section the density and area is  $1 \text{ kg/m}^3$  and  $2 \text{ m}^2$  respectively. What is the velocity at the section?

- A. 1.5
- B. 2.20
- C. 2.25
- D. 1.75

Answer ||| C

Solution |||  $\rho_1 A_1 V_1 = \rho_2 A_2 V_2$

$$1.5 \times 1 \times 3 = 1 \times 2 \times V_2$$

$$V_2 = 2.25 \text{ m/s}$$

29. Which one of the following is the dimension of mass density?

- A.  $M^1 L^{-3} T^0$
- B.  $M^1 L^3 T^0$
- C.  $M^0 L^{-3} T^0$
- D.  $M^0 L^3 T^0$

Answer ||| A

Solution |||

Mass Density ( $\rho$ ) is defined as the mass ( $m$ ) per unit volume ( $V$ ), i.e.,  
 $[\rho] = [m]/[V] = [m] / [L^3] = [ML^{-3}]$ .

30. A 75mm diameter pipe of 1000m length operates under a head 30m at inlet. If a nozzle is fitted at its outlet, then for most efficient conditions the velocity of flow from the nozzle shall be

- A. 24.2 m/s
- B. 36.4 m/s
- C. 12.2 m/s
- D. 19.8 m/s

Answer ||| D

Solution ||| For most efficient section,  $h_f = H/3 = 30/3 = 10\text{m}$

$$V = \sqrt{2g(H - h_f)} = \sqrt{2 * 9.81 * (30 - 10)} = 19.8\text{m/s}$$

31. Velocity measurement of flow through a rough circular pipe indicate that the average velocity is 3.0 m/s and the centerline velocity is 3.5 m/s. What is the friction factor for the pipeline?

- A. 0.0253
- B. 0.0458
- C. 0.01562
- D. 0.0984

Answer ||| C

Solution ||| For both smooth and rough pipe

$$\frac{u_{max}}{u_{avg}} = 1.33\sqrt{f} + 1$$

solving we get

$$f = 0.015625$$

32. A stream flow function is given by  $\Psi = 2x^2y + (x+1)y^2$ . The flow rate across a line joining points A(4,0) and B(0,3) is

- A. 4
- B. 9
- C. 16
- D. 25

Answer ||| B

Solution |||  $\Psi_{(4,0)} = 2 \times 4^2 \times 0 + (4+1) \times 0 = 0$

$$\Psi_{(0,3)} = 2 \times 0 \times 3 + 1 \times 3^2 = 9$$

$$Q = \Psi_{(4,0)} - \Psi_{(0,3)} = 9 - 0 = 9 \text{ unit}$$

33. What is the diameter of the nozzle for maximum power transmission through the nozzle

A.  $d = \left( \frac{D^3}{8 fL} \right)^{1/4}$

B.  $d = \left( \frac{D^3}{8 fL} \right)^{1/3}$

C.  $d = \left( \frac{D^5}{8 fL} \right)^{1/3}$

D.  $d = \left( \frac{D^5}{8 fL} \right)^{1/4}$

Answer ||| D

Solution |||

34. In a floating body  $I$  = Moment of inertia of water line area about the longitudinal axis,  $V$  = Volume of displaced fluid,  $B$  = Centre of pressure,  $G$  = Centre of gravity and  $M$  = Metacentre. For stable equilibrium of this body

- A.  $BG = \frac{I}{V} + MG$
- B.  $MG = \frac{I}{V} + BG$
- C.  $MG = \left(\frac{I}{V}\right) \times BG$
- D.  $BG + MG = \frac{I}{V}$

Answer ||| D

Solution |||  $BG + MG = \frac{I}{V}$

35. Consider following statements:

- 1) metacentric height of a floating body is the distance between metacentre (M) and centre of gravity (G) of a floating body
- 2) For a submerged body to be in stable equilibrium, centre of Buoyancy is above centre of gravity.
- 3) For a floating body to be in unstable equilibrium, metacentre (M) is above centre of gravity (G)

Correct statement(s) is/are

- A. 1, 2 only
- B. 2, 3 only
- C. 1, 3 only
- D. 1, 2 and 3

Answer ||| A

Solution |||

1. Metacentric height of a floating body is distance between metacentre (M) and centre of gravity (G) → Correct
2. For a submerged body to be in stable equilibrium, centre of Buoyancy (B) lies above centre of gravity (G) → Correct
3. For a floating body to be in unstable equilibrium, metacentre (M) should be **below** centre of gravity (G) → Incorrect

36. Seepage through embankments in an earthen dam is controlled by

- A. drainage filters
- B. relief wells
- C. drain trenches
- D. provision of downstream berms

Answer ||| A

Solution |||

Drainage filter will reduce seepage through embankments in an earthen dam.

37. According to Khosla's theory, the exist gradient in the absence of a downstream cutoff is:-

- A. Zero
- B. Unity
- C. Infinity
- D. Very large

Answer ||| C

Solution |||

The main points from Khosla's Theory

- It was absolutely essential to have a reasonably deep vertical cut off at the downstream end to prevent undermining.
- Khosla and his associates took into account the flow pattern below the impermeable base of hydraulic structure to calculate uplift pressure and exit gradient.
- For the standard form consisting of a floor of a length  $b$ , and a vertical cut-off of depth  $d$ , the exit gradient at its downstream end is given by:

- Exit gradient  $GE = (H/d) \times \text{Exit gradient}$

38. Consider the following statements regarding conditional checks for stability of dams:

- 1) Stability of downstream slope during steady seepage.
- 2) Stability of upstream slope during steady seepage.
- 3) Stability of upstream slope during construction.
- 4) Stability of downstream slope during construction.

Which of the above statements are correct?

- A. All four
- B. 1, 2 and 3
- C. 1, 3 and 4
- D. 2 and 3

Answer ||| C

Solution ||| Conditional checks for stability of dams:

Stability of downstream slope during steady seepage.

Stability of both upstream and downstream slope during construction.

Stability of upstream slope during sudden drawdown.

39. Consider the following statements:

- 1). Groynes are constructed projecting from the bank into the river at the bank to be protected from flood.
- 2). Repelling groyne projects upstream into the river—flow from the point of its origin from the bank.
- 3). Attracting groyne projects upstream into the river from the point of its origin from the bank.
- 4). Perpendicular groyne projects upstream into the river from the point of its origin from the bank.

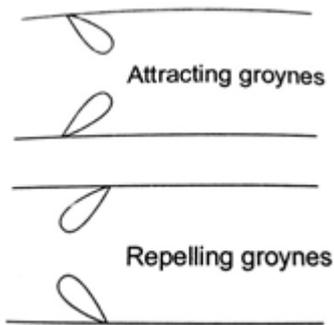
Which of these statements are correct?

- A. 1 and 4
- B. 1 and 2
- C. 2 and 3
- D. 3 and 4

Answer ||| B

Solution ||| Groynes are constructed projecting from the bank into the river at the bank to be protected from flood.

The following figure shows the relative configuration of attracting and repelling groyones. The flow is from the left to the right.



40. Which of the following statement is not correct regarding Sprinkler Irrigation Method?

- A. Can be used for all the crops and for almost all the soils.
- B. Best suited for very light soils as deep percolation losses are avoided.
- C. Flexible to suit undulating topography and hence leveling is not necessary.
- D. About 80% water application efficiency is possible.

Answer ||| A

Solution |||

Sprinkler Irrigation Method can be used for all the crops except rice and jute and for almost all the soils except very heavy soils with very low infiltration rates.

41. For an irrigated field having: Field capacity = 30%, permanent wilting point = 10%, Permissible depletion of available moisture = 40%, Dry weight of soil =  $14.70 \text{ kN/m}^3$ , Unit weight of water =  $9.8 \text{ kN/m}^3$  and effective rainfall = 30 mm, what is the net irrigation requirement per meter depth of soil?

- A. 300 mm
- B. 150 mm
- C. 120 mm
- D. 90 mm

Answer ||| D

Solution ||| Total irrigation water requirement

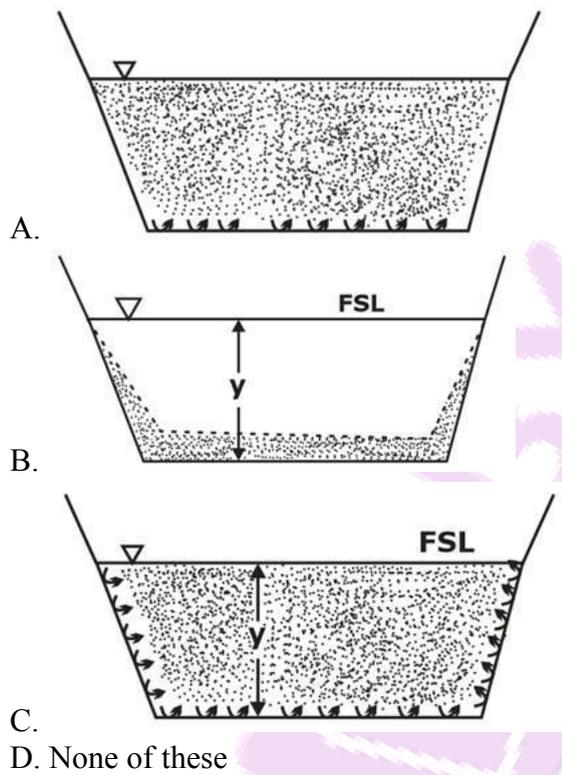
$$= 0.4(0.3 - 0.1) \times \frac{14.7}{9.8} \times 1000$$

$$= 0.4 \times 0.2 \times 1.5 \times 1000$$

$$= 120 \text{ mm}$$

∴ Net irrigation requirement  
= 120 - 30 - 90 mm

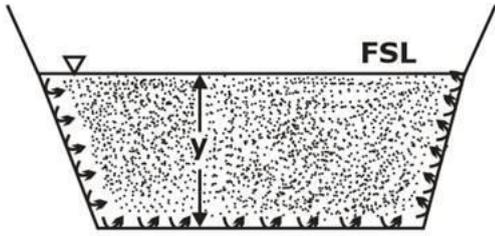
42. Which among the following represent Stable regime?



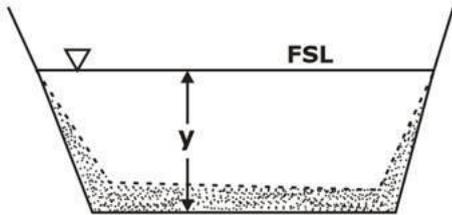
Answer ||| A

Solution |||

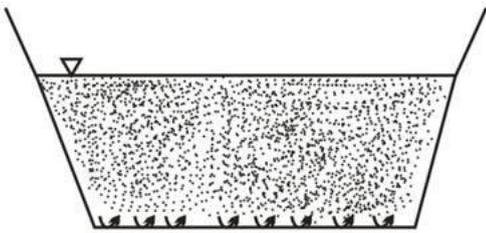
**Scouring**



(ii) Silting



(iii) Regime/Stable



43. Open Sluice Outlet is example of

- A. Non-modular outlets
- B. Semi-modular outlets
- C. Rigid Modules
- D. None of these

Answer ||| A

Solution |||

### Non-modular outlets

- These outlets operate in such a way that the flow passing through them is a function of the difference in water levels of the distributing channel and the water course. Hence, a variation in either affects the discharge.

- Ex - submerged Pipe Outlet. Open Sluice Outlet.

### (b) Semi-modular outlets

- The discharge through these outlets depend on the water level of the distributing channel but is independent of the watercourse so long as the working head required for their working is available.
- The discharge through such outlet will therefore depend on the water level in the distributary.

Ex - Kennedy's Gauge Module or Venturi Flume, Crump's adjustable proportional Module(APM), Open Flume Outlet, Orifice semi-module outlet

**(c) Rigid Modules/Modular outlets**

- The discharge through modular outlets is independent of the water levels in the distributing channel and the watercourse, within reasonable working limits. This type of outlets may or may not be equipped with moving parts.
- Though modular outlets, like the Gibb's module Khanna's Module, Foote's module have been designed and implemented earlier, they are not very common in the present Indian irrigation engineering scenario.

44. In design of alluvial channels, for computing mean velocity of flow, Kennedy used

- A. Chezy's formula
- B. Manning's formula
- C. Kutter's formula
- D. Bazin's formula

Answer ||| C

Solution |||

For computing mean velocity of flow in design of alluvial channels, Kennedy used Kutter's formula.

45. The dam which resist all the external forces by the action of gravity only are known as

- A. Buttress dams
- B. Cantilever dams
- C. Gravity dam
- D. Arch dams

Answer ||| C

Solution |||

46. Which of the forces a gravity dam will be subjected to

- (i) Water pressure
- (ii) Uplift forces
- (iii) Earthquake forces
- (iv) Silt pressure

- A. i, ii and iii
- B. i, iii and iv
- C. ii, iii and iv
- D. All of the above

Answer ||| D

Solution |||

47. A spillway is having 6 spans with clear width 10 m each. Thickness of each 90° cut water nose pier may be taken as 2.5 m. Take rounded abutment and effective height of water above spillway is 16.3 m. The effective length of spillway is \_\_\_\_\_ m.

- A. 56.72
- B. 56.36
- C. 55.29
- D. None of these

Answer ||| D

Solution ||| We know effective length,  $L_e = L - 2 [Nk_p + k_a]H_e$

For 90° cut water nose pier,

$$k_p = 0.01, k_a = 0.1$$

Number of piers,  $N = 5$

$$\text{So, } L_e = 60 - 2[5 \times 0.01 + 0.1] \times 16.3$$

$$L_e = 55.1 \text{ m}$$

48. The type of transition curve that is generally provided on hill road is

- A. Circular
- B. Cubic parabola
- C. Lemniscate
- D. Spiral

Answer ||| D

Solution |||

As per IRC, ideal shape of transition curve is spiral because rate of change of radial acceleration remain constant.

49. It is a common practice to design a highway to accommodate the traffic volume corresponding to

- A. Peak hour
- B. 15 min peak period
- C. 30<sup>th</sup> hour
- D. Average Daily Traffic

Answer ||| C

Solution |||

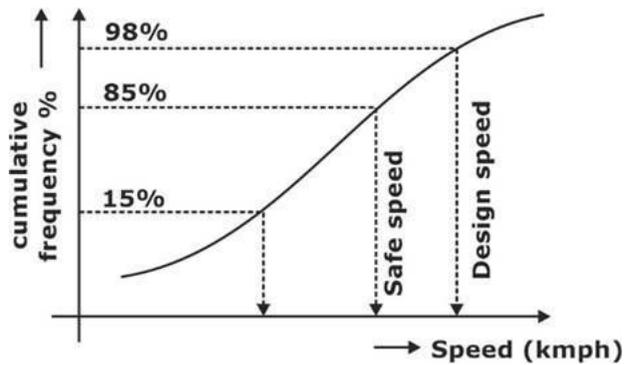
Design of highway is based on traffic volume corresponding to 30<sup>th</sup> hours.

50. Based on spot speed data which speed is used for geometric design of roads?

- A. 15 percentile
- B. 50 percentile
- C. 85 percentile
- D. 98 percentile

Answer ||| D

Solution |||



98<sup>th</sup> percentile speed = Design speed

85<sup>th</sup> Percentile speed = Upper safe limit

15<sup>th</sup> Percentile speed = lower safe limit

51. The rate of rise/fall of the road surface along its length, is called

- A. Cant
- B. Super-elevation
- C. Banking
- D. Gradient

Answer ||| D

Solution |||

The rate of rising/fall of the road surface along its length is called gradient.

Type of gradient

- i) Ruling gradient
- ii) Limiting gradient
- iii) Exceptional gradient
- iv) Minimum gradient.

52. As per I.R.C., it is considered appropriate that roads in rural areas should be designed for

- A. 20 - 25 years
- B. 15 - 20 years
- C. 10 - 15 years
- D. 5 - 10 years

Answer ||| D

Solution |||

As per IRC (Indian road congress), the standard value of design life for the rural roads is considered 10 years. But in the case of low volume roads (thin bituminous roads) design life is 5 years.

53. In railways, most severe gradient is

- A. Gradients of rack railways
- B. Pusher gradient
- C. Momentum gradient
- D. Exceptional gradient

Answer ||| B

Solution |||

For railways: -

Pusher gradient > momentum gradient > Ruling gradient > minimum gradient

In mountainous region where Ruling gradient (design gradient) can not be provided, pusher/helper gradient is provided with additional engine.

In general for gradient above 1: 75, pusher/helper engine is used.

Max<sup>m</sup> gradient permitted in station yard is  $\frac{1}{400}$  to  $\frac{1}{1000}$

54. Cant deficiency becomes an inevitable consideration on a main line and branch line moving in

- A. same direction
- B. opposite direction
- C. cross direction
- D. None of the above

Answer ||| A

Solution |||

Cant Deficiency: - It occurs when a train travels around a curve at a speed higher than the equilibrium speed. It is the difference between theoretical cant required for such higher speed and actual cant provided.

55. A tunnel should NOT be constructed along

- A. Strike direction
- B. Dip direction
- C. Oblique to the bed altitude
- D. Both along dip and strike direction

Answer ||| A

Solution |||

Strike is the direction of the line formed by the intersection of a fault's other planar feature in a horizontal plane.

So, strike is due to faults along strike become pressure will not have distributed and will concentrated along a vertical plane.

56. Which one is NOT a road pattern?

- A. Block pattern
- B. Star and block pattern
- C. Hexagonal pattern
- D. Diamond pattern

Answer ||| D

Solution |||

Different Road patterns are

- a. Rectangular and block pattern,
- b. Star and block pattern,
- c. Star and grid pattern,
- d. Star and circulation pattern,
- e. Hexagonal road pattern.

57. The Govt. of India, appointed the National Transport Policy Committee in the year

- A. 1978
- B. 1973
- C. 1956
- D. 1943

Answer ||| A

Solution |||

National transport policy, which was appointed by Govt of India was came in 1978.

58. Flexible pavement distribute the wheel load

- A. Directly to subgrade
- B. Through a set of layers to the subgrade
- C. Through structural action
- D. None of the above

Answer ||| B

Solution |||

Distribution of the wheel load is distributed to flexible pavement through a set of layer to the sub grid.

59. In a vertical curve, an upgrade of 2.0% is followed by a downgrade of 2.0%. The rate of change of grade is 0.05% per 20 m chain. The length of the vertical curve will be

- A. 800 m
- B. 1000 m
- C. 1200 m
- D. 1600 m

Answer ||| D

Solution |||

Given,

In a vertical curve,

Upgrade  $n_1 = 2.0\%$

And downgrade  $n_2 = -2.0\%$

$$\text{So, } N = |n_1 - n_2|$$

$$N = |2.0 - (-2.0)| = 4.0\%$$

and pressure drop per unit length will be, and rate of change of grade,

$\Rightarrow 0.05\%$  per 20 m chain.

Length of vertical curve

$$= \frac{\text{Total change of grade}}{\text{rate of change of grade}}$$

$$= \frac{4}{0.05} \times 20$$

= 1600 meter.

60. For the COD test of sewage, organic matter is oxidized by Potassium dichromate ( $\text{K}_2\text{Cr}_2\text{O}_7$ ) in the presence of

- A. Sulphuric Acid
- B. Nitric Acid
- C. Hydrochloric Acid

D. Acetic Acid

Answer ||| A

Solution |||

The COD uses potassium dichromate ( $K_2Cr_2O_7$ ) in presence of concentrated  $H_2SO_4$  solution to oxidize both organic and inorganic substances in waste water sample.

61. Maximum discharge through a circular channel takes place when depth of flow is equal to

- A. 0.95 times the diameter
- B. 0.3 times diameter
- C. 0.81 times diameter
- D. 0.5 times diameter

Answer ||| A

Solution |||

Maximum discharge = .95D

Maximum velocity = .810

62. Find out the correct pair(s):

List - I (Waste type)	List - II (Dustbin Colour)
I. Plastic	Blue
II. e-Waste	Black
III. Human anatomical waste	Yellow
IV. Kitchen waste	Brown

Correct Pair(s) is/are:

- A. I, II, III
- B. I, III, IV
- C. I, II, III, IV
- D. III, IV

Answer ||| A

Solution |||

Plastic – Green for wet, blue for dry

E-waste – black

Human anatomical waste – yellow

Kitchen waste – Green for urea, blue for dry.

63. Use of Neem for coating of urea has many advantages. Pick up the incorrect statement

- A. Neem coating leads to more gradual release of urea, helping plants gain more nutrient and resulting in higher yields.
- B. Neem serves as a natural insecticide.
- C. Collection of Neem seeds is needed for manufacturing of Neem coated urea. This would generate employments in rural areas.
- D. Increase underground water contamination due to leaching of urea.

Answer ||| A

Solution ||| Neem for coated urea is a fertilizer and an agriculture scheme initiated by the Govt. of India to boost the growth of wheat and paddy and curb the black market and hoarding of urea.

64. In a Stokes's experiment of falling sphere, it is found that a sphere of 5 mm diameter falls in a liquid with terminal velocity 20 mm/s giving a drag coefficient of 240. The ratio of specific gravities is 2.85. Which one of the following is the kinematic viscosity of the liquid in stokes?

- A. 3.5
- B. 10.0
- C. 1000.0
- D. 225.0

Answer ||| B

Solution |||

$$C_D = \frac{24}{R_c} = \frac{24v}{VD}$$

$$240 = \frac{24 \times v}{2 \times .5}$$

$$v = 10 \text{ stokes}$$

65. Pick out the incorrect statement:

- A. In rapid sand filter, no treatment is required before we fed the water in to the respective filter.
- B. In slow sand filter, loss of head is less as compared to rapid sand filter.
- C. Slow sand filter is less efficient in removing the colour as compared to rapid sand filter.
- D. No post disinfection is required in slow sand filter.

Answer ||| C

Solution |||

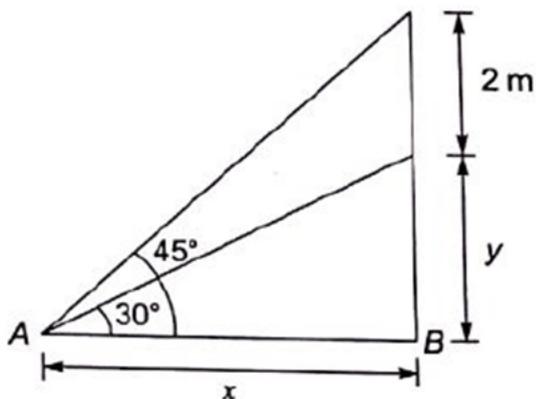
Slow sand filter is high efficient in removing the color as compared to rapid sand filter.

66. The angles of elevation from A to the top and bottom of a road of length 2 m held vertically at B are  $45^\circ$  and  $30^\circ$  respectively. The horizontal distance AB is:

- A. 4.732 m
- B. 1.268 m
- C. 3.464 m
- D. 0.789 m

Answer ||| A

Solution |||



$$\tan 30^\circ = \frac{y}{x} = \frac{1}{\sqrt{3}}$$

$$\tan 45^\circ = 1 = \frac{y+2}{x}$$

$$\Rightarrow x = y + 2$$

$$\frac{y}{y+2} = \frac{1}{\sqrt{3}}$$

$$\Rightarrow 1 + \frac{2}{y} = \sqrt{3} \Rightarrow y = 2.732m$$

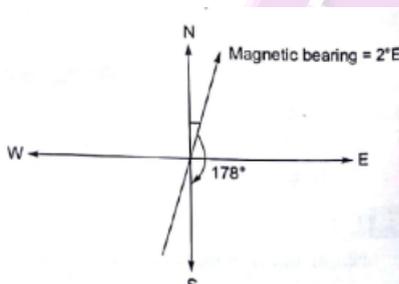
$$x = y + 2 = 4.732m$$

67. The magnetic bearing of the sun at noon is  $178^\circ$ . The magnetic declination at the place is

- A.  $2^\circ$  W
- B.  $2^\circ$  E
- C.  $2^\circ$  N
- D.  $2^\circ$  S

Answer ||| B

Solution |||



68. If the intercept on a vertical staff is observed as 0.75 m from a tachometer with the line of sight horizontal, fitted with anallatic lens, the horizontal distance between the tachometer and the staff station is

- A. 0.75 m
- B. 7.5 m
- C. 75 m
- D. 750 m

Answer ||| C

Solution |||

$$D = KS + C$$

for an allatic lens

$$K = 100 \text{ and } C = 0$$

$$D = 100 \times 0.75 + 0$$

$$= 75 \text{ m}$$

69. Well conditioned angle of a triangle in plane table surveying is

- A.  $50^\circ 40'$
- B.  $56^\circ 14'$
- C.  $60^\circ 20'$
- D.  $66^\circ 15'$

Answer ||| B

Solution ||| The triangles of such slopes, in which any error in the angular measurements has a minimum effect in the calculation of sides is known as well conditioned triangle.

The most ideal situation is when the angles are closer to  $60^\circ$ , but it can be proved mathematically that an isosceles triangle of base angle  $56^\circ 14'$  gives rise to minimum error.

70. The BS is 6.655m taken on BM of RL 400.000. If FS is 1.45m, RL of the last station is:

- A. 394.795
- B. 401.450
- C. 405.205
- D. 406.655

Answer ||| C

Solution |||

Using height of instrument method,

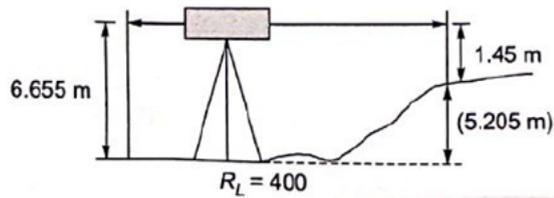
$$HI = RL + BS$$

$$= 400 + 6.625 = 406.655 \text{ m}$$

Now, RL of last station = HI - FS

$$= 406.655 - 1.45 = 406.205 \text{ m}$$

Figuratively



71. The sun is at the Autumnal Equinox on:

- A. March 21
- B. June 21
- C. September 21
- D. December 21

Answer ||| C

Solution ||| Due to differences between the calendar year and the tropical year, the September equinox may occur anytime from September 21 to 24. At the equinox, the Sun as viewed from the equator rises due east and sets due west.

72. In geodetic survey, all plumb lines are

- A. Radial
- B. Continuous
- C. Parallel
- D. Perpendicular

Answer ||| A

Solution ||| Since in geodetic survey, curvature effect of earth is taken into account, plumb lines will be radial.

73. In building drawing, which factor is not considered on studying of site?

- A. number of gender ratio
- B. number of people using the building
- C. type of people, their education, awareness
- D. dressing sense of the people

Answer ||| D

Solution |||

After these studies planner must have an interaction with the master/residents to understand the following:

- a) Aim/objective/purpose of building
- b) Number of people using the building
- c) Type of people, their education, awareness
- d) Art and culture of the people etc.

74. Number of principal plane views are

- A. 3
- B. 4
- C. 5
- D. 6

Answer ||| D

Solution |||

Object is assumed to be inside a cube

1. Front view
2. Rear view
3. To view

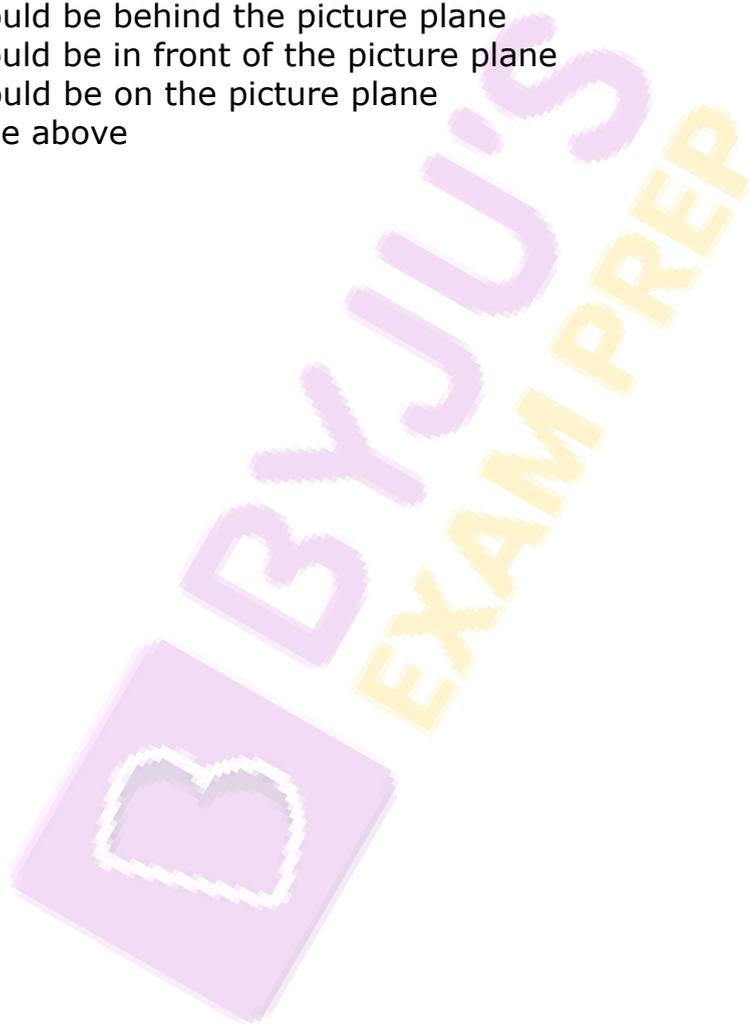
4. Bottom view
5. Left hand view
6. Right hand view

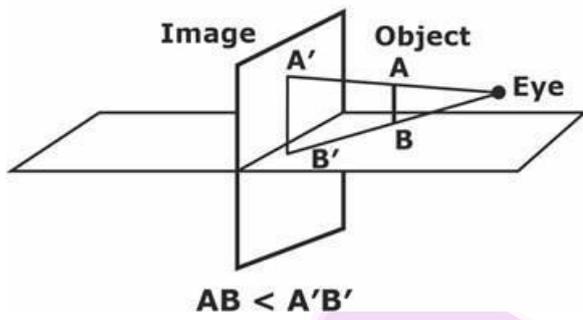
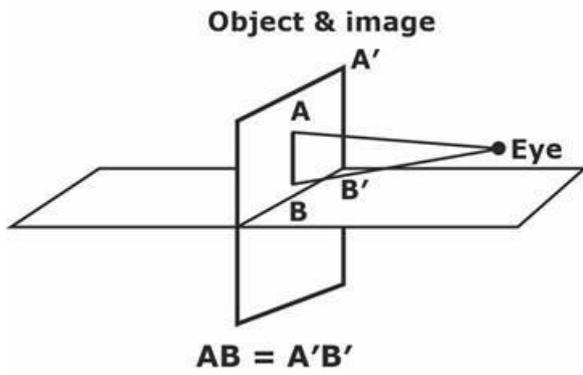
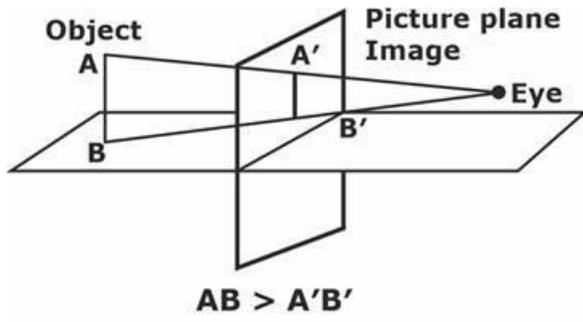
75. In order to obtain an enlarged perspective view, what is the position of object with respect to picture plane?

- A. Object should be behind the picture plane
- B. Object should be in front of the picture plane
- C. Object should be on the picture plane
- D. None of the above

Answer ||| B

Solution ||| .





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EXAM PREP

