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ESE - 2025

Preliminary Examination

QUESTIONS WITH DETAILED SOLUTIONS

CIVIL ENGINEERING

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SUBJECTWISE WEIGHTAGE

S.No.	Name of the Subject	Number of Questions
1	Strength of Materials	23
2	Structural Analysis	1
3	Construction Practice, Planning & Management	13
4	Reinforced Cement Concrete & PSC	9
5	Design of Steel Structures	10
6	Geotechnical Engineering	17
7	Fluid & Hydraulic Machines + OCF	15
8	Hydrology	2
9	Irrigation Engineering	12
10	Environmental Engineering	13
11	Transportation Engineering	13
12	Surveying	10
13	Building Materials	11
14	Geology	1
Total No. Of Questions		**150**

01. In a district where the rainfall is heavy, a major district road of WBM pavement, 3.8 m wide, is to be constructed. The height of the crown with respect to the edges is

(a) 0.058 m (b) 0.072 m
(c) 0.064 m (d) 0.049 m

01. Ans: (a)

Sol: WBM road in heavy rain fall region, camber = 1 in 33 as per IRC.

$W = 3.8$ m

The height of crown with respect to edges,

$$y_{max} = \frac{W}{2N} = \frac{3.8}{2(33)} = 0.058 \text{ m}$$

02. If a crossover occurs between two MG parallel tracks of same crossing number 1 in 12 with straight intermediate portion between the reverse curves and the distance between the centres of the track is 3.5 m, the overall length of the crossover will be nearly

(a) 54 m (b) 58 m
(c) 62 m (d) 66 m

02. Ans: (d)

Sol: $G = 1$ m

$D = 3.5$ m

$$\frac{1}{N} = \frac{1}{12}$$

Straight intermediate portion

$\Rightarrow l = (D + 2G)\,N$

$\Rightarrow l = (3.5 + 2)12 = 66$ m

03. A transition curve of 90 m length is to be used to join the ends of 4° circular curve within straight and circular curve. The shift value and the offset value at 30 m are respectively, nearly

(a) 0.8 m and 11.6 cm (b) 0.6 m and 11.6 cm
(c) 0.6 m and 15.4 cm (d) 0.8 m and 15.4 cm

03. Ans: (a)

Sol: $L = 90$ m

$D^o = 4^o$

$$R = \frac{1720}{D} = \frac{1720}{4} = 430 \text{ m}$$

$$S = \frac{L^2}{24R} = \frac{90^2}{24 \times 430} = 0.787 \simeq 0.8 \text{ m}$$

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

$$\Rightarrow y = \frac{30^3}{6 \times 430 \times 90} = 0.116 \text{ m} = 11.6 \text{ cm}$$

04. Which of the following is/are the correct reason(s) to provide the gradient on the railway track?

1. To provide moderate rise or fall
2. To reach the various stations located at different elevators
3. To reduce the cost of earthwork

Select the correct answer.

(a) 1 only (b) 2 and 3 only
(c) 3 only (d) 1, 2 and 3

04. Ans: (d)

Sol: Gradients are essential in railway track design to ensure smooth operation and cost efficiency. The correct reasons for providing gradients include:

- To provide a uniform rate of rise or fall – This helps maintain a manageable slope for trains.
- To reach various stations at different elevations -Railways often need to adjust track levels to connect stations at varying heights.
- To reduce the cost of earthwork – Proper gradient design minimizes excessive excavation and filling, making construction more economical

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05. An exit taxiway for an airport is to be designed. If the turnoff speed is 80 kmph and the coefficient of friction between tire and pavement surface is 0.13, the radius of the central curve will be nearly

(a) 354 m (b) 372 m
(c) 394 m (d) 422 m

05. Ans: (c)

Sol: V = 80 kmph ; f = 0.13

$$\text{Radius, } R = \frac{V^2}{125\,f} = \frac{80^2}{125\,(0.13)}$$

R = 394 m

06. Which of the following is/are the correct characteristic(s) of an ideal elastic fastening?

1. It should be able to maintain correct and uniform gauge
2. It should be of a very particular type
3. It shall offer elasticity of low level

Select the correct answer.

(a) 1 only (b) 2 and 3 only
(c) 3 only (d) 1, 2 and 3

06. Ans: (a)

Sol: Rail fastenings should have high elasticity.

∴ by elimination ans (a)

07. Which of the following equipments are used for track recording by Indian Railways?

1. Track recording trolley
2. Track recording car
3. Rail-flaw detector
4. Hallade track recorder

Select the correct answer.

(a) 1, 2, 3 and 4 (b) 2 and 3 only
(c) 1 and 4 only (d) 1, 2 and 3 only

07. Ans: (a)

Sol: Indian Railways uses several track recording equipment to monitor track conditions and ensure safety. The following equipment are commonly used:

Track recording cars – These are used for continuous monitoring of track geometry.

Hallade track recorder – A mechanical device used for recording track alignment.

Rail-flaw detectors – Used for detecting internal defects in rails.

The track recording trolley is not explicitly mentioned in the sources, but portable accelerometers and oscillograph cars are also used for track monitoring

08. Which one of the following is an important point for an efficient airport vehicular circulation and parking system?

(a) Two-way traffic wherever possible
(b) A maximum of driveway inter- sections
(c) Inadequate driveway width to permit overtaking
(d) Sufficiently and clearly defined parking and circulation routes

08. Ans: (d)

Sol: For efficient vehicular circulation and parking, it is better to avoid two way traffic, adequate drive way width is required. Drive way intersections should be as minimum as possible. The best option (with process of elimination is (d).

09. The suitability of an area, as a site for airport terminal building development, is evolved in accordance with
(a) small area of car parking
(b) no direct access to main highways
(c) distant location with respect to runway
(d) sufficient area for the first stage of building development with possibility of future expansion

09. Ans: (d)

Sol: For the airport terminal building sufficient area is required. Also area for future development is also required. Therefore the best suitable option is (d)

Directions :
Each of the following six (06) items consists of two statements, one labeled as 'Statement (I)' and the other as 'Statement (II)'. You are to examine these two statements carefully and select the answers to these items using the codes given below :

Codes :
(a) Both Statement (I) and Statement (II) are individually true and Statement (II) is the correct explanation of Statement (I)
(b) Both Statement. (I) and Statement (II) are individually true but Statement (II) is not the correct explanation of Statement (I)
(c) Statement (I) is true but Statement (II) is false
(d) Statement (I) is false but Statement (II) is true.

10. **Statement (I):** The water below the water table is known as soil moisture and above the water table as groundwater.

Statement (II): Extending down from the ground surface, is the soil zone or root zone, which is defined as being the depth of overburden that is penetrated by the roots of vegetation.

10. Ans: (d)

Sol: Statement I is incorrect. Groundwater is the water found below the water table, while soil moisture is the water present in the unsaturated zone above the water table.
Statement (II) correctly describes the soil zone or root zone as the upper layer of the ground where plant roots can penetrate and absorb water.

11. **Statement (I):** The rainwater collection for direct use can be practiced by collecting the water coming down from the roof into a storage tank of plastic, RCC or masonry.
Statement (II): In a campus, where sufficient space is not available, the water can be stored in an open excavated pond.

11. Ans: (c)

Sol: **Statement (I):** The rainwater collection for direct use can be practiced by collecting the water coming down from the roof into a storage tank of plastic, RCC or masonry.
This statement is correct.
This is a widely adopted rainwater harvesting method for direct usage, particularly in urban households and institutions.
Statement (II): In a campus, where sufficient space is not available, the water can be stored in an open excavated pond.
This statement is not appropriate in the given context.

If sufficient space is not available, then storing in an open excavated pond is not feasible, as such a pond would require more land area. Therefore, the logic of the statement is flawed.
Statement I is correct
Statement II is incorrect

12. **Statement (I):** The soils in nature rarely exist separately as gravel, sand, silt, clay or organic matter.
Statement (II): The classification or grouping of soils is mainly based on one or two index properties of soil.

12. Ans: (b)

Sol:

- Statement (I) is correct: Natural soils are typically a mixture of different particle sizes, including gravel, sand, silt, clay, and organic matter. Pure deposits of a single type are rare in nature.
- Statement (II) is also correct: Soil classification is primarily based on index properties such as particle size distribution, Atterberg limits. These properties help engineers and geologists categorize soils for various applications.

13. **Statement (I):** During pile driving, heads, helmets or caps are placed on the top of the pile to receive the blows of the hammer and to prevent damage to the head of the pile.
Statement (II): Piles are ordinarily driven to a resistance measured by the number of blows required for the last 5 cm of penetration.

13. Ans: (b)

Sol:

- Statement (I) is correct: Helmets, caps, or heads are placed on top of piles to absorb the impact of hammer blows and prevent damage to the pile head during driving.
- Statement (II) is also correct: Piles are typically driven until they reach a specified resistance, which is measured by the number of hammer blows required for the last few centimeters of penetration. This ensures the pile has reached the necessary bearing capacity.

14. **Statement (I):** The critical condition of d/s slope occurs when the reservoir is full and percolation is at its maximum rate.
Statement (II): The direction of seepage forces tends to increase the stability.

14. Ans: (c)

Sol: Seepage forces tends to decrease the stability of downstream slope but increase the stability of upstream slope. Hence statement II is false.

15. **Statement (I):** Dynamic surveying implies some sort of motion. It allows user to move during surveying and to collect data on move.
Statement (II): Rapid static surveying technique, also known as fast static technique, is much like static surveying except that the occupation times are longer.

15. Ans: (c)

Sol: Statement (I) is correct: Dynamic surveying involves movement during data collection, allowing surveyors to gather information while in motion.

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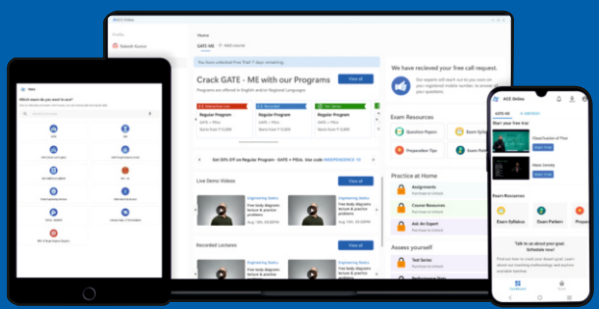

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This is commonly used in applications like GPS-based mapping and mobile LiDAR scanning.

Statement (II) is incorrect: Rapid static surveying is actually a short-duration version of static surveying, not a longer one. It requires shorter occupation times (typically 5-20 minutes) compared to traditional static surveying, which can take hours

16. The area of the plan of an old survey plotted to a scale of 15 m to 1 cm now measures as 80.2 cm^2 as found by a planimeter. The plan is found to be shrunk, so that a line originally 10 cm long now measures 9.8 cm. The true area of the survey will be nearly

(a) 81.5 m^2 (b) 83.5 m^2
(c) 85.5 m^2 (d) 87.5 m^2

16. Ans: (b)

Sol: Shrinkage ratio (SR)

$$SR = \frac{9.8\ cm}{10\ cm} = 0.98$$

Measured area = 80.2 cm^2

$$\text{Correct area} = \frac{80.2\ cm^2}{SR^2} = \frac{80.2}{0.98^2} = 83.506\ cm^2$$

But options are in "m^2"

Scale $\Rightarrow$1 cm = 15 m

$\Rightarrow$ 1 cm^2 = 225 m^2

$\Rightarrow$ 83.5 cm^2 = 83.5 × 225 m^2

= 18787.5 m^2

There might be a printing mistake in the options

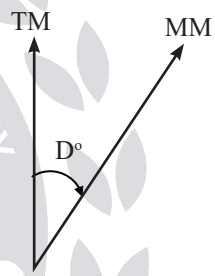
Select (b)

17. Magnetic declination at a place is

(a) the horizontal angle which a line makes with true meridian
(b) the horizontal angle which a line makes with the magnetic meridian
(c) the horizontal angle between the true meridian and the magnetic meridian
(d) the horizontal angle which a line makes with arbitrary meridian

17. Ans: (c)

Sol:

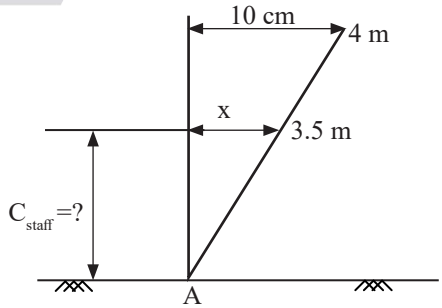


18. The staff reading with a 4 m staff at a point A is 3.5 m. The top of the staff is 10 cm off the vertical through the bottom of the staff. If the staff is held vertically, the correct reading will be nearly

(a) 3.0 m (b) 3.4 m
(c) 3.8 m (d) 4.2 m

18. Ans: (b)

Sol:



$$\frac{x}{10\text{ cm}} = \frac{3.5\text{ m}}{4\text{ m}}$$

$\Rightarrow x = 8.75$ cm

$$\Rightarrow C_{staff} = \sqrt{3.5^2 - \left(\frac{8.75}{100}\right)^2}$$

$= 3.49$ m

19. The circumpolar stars are having polar distances
(a) equal to the latitude of the place of the observation
(b) less than the latitude of the place of the observation
(c) twice the latitude of the place of the observation
(d) thrice the latitude of the place of the observation

19. Ans: (b)

Sol: For a circumpolar star, the polar distance should be either equal to or less than the latitude of observer's position.

20. In electromagnetic wave theory concept, the energy Q is
(a) $\frac{hc}{\lambda}$ (b) $\frac{\lambda c}{h}$ (c) $\frac{h}{\lambda c}$ (d) $\frac{\lambda h}{c}$
where h is Planck's constant, λ is wavelength and c is velocity.

20. Ans: (a)

Sol: As per Quantum theory

$Q = hf$ ..... (1)

But wave theory says

$\lambda \propto \frac{1}{f}$

$\Rightarrow \lambda = \frac{c}{f}$ .....(2)

From (1) & (2)

$Q = \frac{hc}{\lambda}$

21. Which one of the following statements is correct in case of map versus aerial photograph?
(a) Map is an orthogonal projection, whereas an aerial photograph is a central projection.
(b) Both a map and a photograph have constant scale.
(c) The amount of details both on a map and on an aerial photograph is selective.
(d) Due to symbolic representation, the clarity of details is more on a photo than on a map.

21. Ans: (a)

Sol: Maps are orthographic projections.
Photographs are perspective (central) projections.

22. If the centrifugal ratio is given and comfort conditions hold good, the length of transition curve L for roads will be
(a) $16.52\sqrt{R}$ (b) $12.80\sqrt{R}$
(c) $8.80\sqrt{R}$ (d) $4.52\sqrt{R}$
where R is radius.

22. Ans: (b)

Sol: Length of transition curve for roads is
$L = 12.80\sqrt{R}$
where R = Radius of circular curve in 'm'

23. Which one of the following is an advantage for providing the transition curve on a road?
(a) It allows a sudden transition of curvature from the tangent to the circular curve
(b) The radius of curvature increases suddenly
(c) It is provided for the sudden change in superelevation
(d) It eliminates the danger of derailment, overturning or slide- slipping of vehicles and discomfort to passengers

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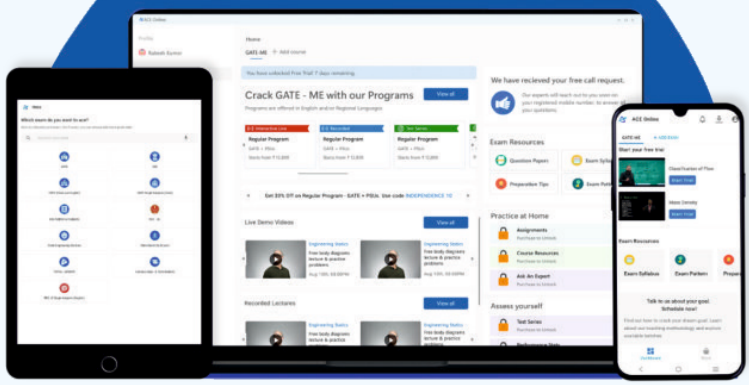

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23. Ans: (d)

Sol: By providing transition curve derailment of trains can be avoided on railway track. Also side slipping (skidding) and over turning of vehicles can be avoided on curved roads.

24. A double-acting reciprocating pump, running at 40 r.p.m., is discharging 1.0 m^3 of water per minute. The pump has a stroke of 400 mm. The diameter of piston is 200 mm. The delivery and suction head are 20 m and 5 m respectively. The theoretical discharge for the double-acting pump is

(a) $\frac{1.6\pi}{300}\ m^3/s$ (b) $\frac{0.8\pi}{300}\ m^3/s$

(c) $\frac{2.4\pi}{300}\ m^3/s$ (d) $\frac{0.4\pi}{300}\ m^3/s$

24. Ans: (a)

Sol: $Q_{th} = \frac{ALN}{30} = \frac{\pi}{4} \times 0.2^2 \times 0.4 \times \frac{40}{30}$

$= \frac{1.6\pi}{300}\ m^3/s$

25. The plunge of the fold is

(a) a line drawn parallel to the hinge line of a fold

(b) the angle of inclination of the fold axis with the horizontal as measured in a vertical plane

(c) a line representing the intersection of the axial plane of a fold with any bed of the fold

(d) a line drawn vertical to the hinge line of a fold

25. Ans: (b)

Sol: "In structural geology, the plunge of a fold refers to the angle at which the hinge line (or fold axis) inclines from the horizontal."

26. A transition curve should satisfy which of the following conditions?

1. It should meet the straight line part of the road tangentially
2. The length of it must be such that the cant or superelevation can be provided conveniently to its maximum value at the beginning of the circular curve
3. The rate of increase of the curvature should be such that it matches with the rate of increase of cant

Select the correct answer.

(a) 1 and 2 only (b) 1 and 3 only

(c) 2 and 3 only (d) 1, 2 and 3

26. Ans: (d)

Sol:

- Transition curve should be tangential to straight road and also tangential to circular curve, for smooth entry and exit of vehicles on transition curve.
- Super elevation should be gradually introduced on transition curve.
- Along the length of transition curve the super elevation should increase with decrease in radius (R) and should increase with radius of curvature $\left(e = \frac{1}{R}\right)$.

All the statements given are true.

27. The total length L of valley transition curve for comfort condition is

(a) $2\left[\frac{Nv^3}{C}\right]^{\frac{1}{2}}$ (b) $\frac{1}{2}\left[\frac{Nv^2}{C}\right]^{\frac{1}{2}}$

(c) $2\left[\frac{Nv^2}{C}\right]^{\frac{1}{2}}$ (d) $\frac{1}{2}\left[\frac{Nv^3}{C}\right]^{\frac{1}{2}}$

where N is deviation angle, v is design speed and C is allowable rate of change of centrifugal acceleration.

27. Ans: (a)

Sol: Length of valley curve $= 2\left[\frac{Nv^3}{c}\right]^{1/2}$

N = Deflection angle of gradients (as a ratio)

v = speed in m/s

C = rate of change of centrifugal acceleration (m/s^3)

28. For a roadway of 100 km/hr design speed, if the maximum allowable super- elevation rate is 0.12 and the maximum friction coefficient is 0.12, the minimum radius of curvature will be

(a) 328 m (b) 304 m

(c) 288 m (d) 264 m

28. Ans: (a)

Sol: V = 100 kmph ; f = 0.12 ;e = 0.12

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

$$0.12 + 0.12 = \frac{100^2}{127\,R}$$

$$R = 328 \text{ m}$$

29. The vertical stress σ_z under a uniformly distributed circular load based on Boussinesq's theory is

(a) $p\left[1-\frac{z^3}{(a^2+z^2)^{\frac{3}{2}}}\right]$ (b) $p\left[1+\frac{z^3}{(a^2+z^2)^{\frac{3}{2}}}\right]$

(c) $p\left[1-\frac{z^2}{(a^2+z^2)^{\frac{3}{2}}}\right]$ (d) $p\left[1+\frac{z^2}{(a^2+z^2)^{\frac{3}{2}}}\right]$

where p is surface pressure, z is depth at which σ_z is computed and a is radius of loaded area.

29. Ans: (a)

Sol: $\sigma_z = p\left[1-\left\{\frac{1}{1+\left(\frac{a}{z}\right)^2}\right\}^{3/2}\right]$

On rearranging, we get

$$\sigma_z = p\left[1-\left\{\frac{z^2}{z^2+a^2}\right\}^{3/2}\right]$$

$$= p\left[1-\frac{z^3}{(z^2+a^2)^{3/2}}\right]$$

30. In the CBR method of pavement design, the mixed commercial vehicles with different axle loads are to be converted in terms of the cumulative number of standard axle load N_S, using the equation

(a) $N_S = \frac{365A\left[(1+r)^n-1\right]}{r}\times F$

(b) $N_S = \frac{365A\left[(1+r)^n+1\right]}{r}\times F$

(c) $N_S = \frac{365A\left[(1-r)^n-1\right]}{r}\times F$

(d) $N_S = \frac{365A\left[(1-r)^n+1\right]}{r}\times F$

Where A is number of vehicles/day for completed construction for number of lanes, r is annual growth rate of commercial vehicles, n is design life of pavement and F is vehicle damage factor.

30. Ans: (a)

Sol: Cumulative standard axles

$(Csa) = \frac{365A}{r}\left[(1+r)^n-1\right]f$ with usual notation

[assume lane distribution factor, D = 1]

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31. Which one of the following lists identifies the wastes from common manufacturing and industrial process, such as solvents that have been used in cleaning or degreasing operations?
(a) The F-list (b) The K-list
(c) The P-list (d) The U-list

31. Ans: (a)

Sol: As per E.P.A (Environmental Protection Agency).
F_{list}: wastes from common manufacturing & industrial process, like solvents for cleaning, degreasing or metal finishing.

32. When once a pocket of smoke, containing air pollutants, is released into the atmosphere from a source like an automobile or a factory chimney, it gets dispersed into the atmosphere into various directions depending upon the
1. prevailing winds
2. temperature
3. pressure conditions
Select the correct answer.
(a) 1 and 2 only (b) 1 and 3 only
(c) 2 and 3 only (d) 1, 2 and 3

32. Ans: (d)

Sol: Wind speed, temperature, pressure and humidity are important factors contributing for dilution & dispersion into atmosphere.

33. During the compaction test, the weight of compacted soil specimen along with mould is 38.2 N. The volume and weight of mould are 0.95×10^{-3} m^3 and 20.5 N respectively and the water content is 12%. The dry unit weight of the compacted specimen will be nearly
(a) 16.6 kN/m^3 (b) 14.4 kN/m^3
(c) 12.6 kN/m^3 (d) 10.4 kN/m^3

33. Ans: (a)

Sol: $\gamma = \frac{W}{V}$

$= \frac{38.2 - 20.5}{0.95 \times 10^{-3}} = 18.63 \times 10^3 \text{N/m}^3$

$= 18.63 \text{ kN/m}^3$

$\gamma_d = \frac{\gamma}{1 + w}$

$= \frac{18.63}{1 + 0.12} = 16.63 \text{ kN/m}^3$

34. Which one of the following is a time-dependent reversible process in which materials under constant composition and volume soften when remolded?
(a) Sensitivity
(b) Hydraulic conductivity
(c) Thixotropy
(d) Elasticity

34. Ans: (a)

Sol: Sensitivity indicates softening of soil and loss of shear strength when remoulded. Thixotropy refers to regaining of lost strength, with time.

35. The compressibility of a saturated, clay-water system is determined by means of the apparatus devised by Terzaghi known as
(a) Compressometer
(b) Oedometer
(c) Casagrande meter
(d) Azzouz meter

35. Ans: (b)

Sol: Consolidometer is also called Oedometer.

36. In a flow net for a sheet pile wall, the number of flow paths is 5 and the number of equipotential drops is 10. If the coefficient of permeability is 6×10^{-3} mm /s and the head is 4.5 m, the seepage under the wall will be nearly
(a) 1367 L/day (b) 1223 L/day
(c) 1167 L/day (d) 1023 L/day

36. Ans: (c)

Sol: $q = K.h.\frac{N_f}{N_d}$

$K = 6 \times 10^{-3}$ mm/s $= 6 \times 10^{-6}$ m/s

$q = 6 \times 10^{-6} \times 4.5 \times \frac{5}{10}$

$= 13.5 \times 10^{-6}$ m³/s

$= 13.5 \times 10^{-6} \times 60 \times 60 \times 24 = 1.1664$ m³/day

or 1166.4 lit/day

37. Which of the following types of conventional tests will be conducted on clay soils to test the shearing strength?
(a) Undrained or quick tests
(b) Unconsolidated-quick tests
(c) Drained tests
(d) Consolidated-slow tests

37. Ans: (a)

Sol: As the clayey soils are low permeable, they remain unconsolidated and undrained for most of the time. Hence UU-test is recommended for the low permeable soils. UU Test is also called Quick test.

38. Which of the following are the advantages of reinforced earth structures?
1. These are quite flexible
2. The elements can be transported easily
3. These can be constructed in stages
4. The elements used are not easily available
Select the correct answer.
(a) 1 and 2 only (b) 2 and 4 only
(c) 1, 2 and 3 (d) 2, 3 and 4

38. Ans: (c)

Sol: Reinforced earth structures offer several advantages, including flexibility, ease of transportation, and staged construction.
These structures are widely used in retaining walls, bridge abutments, and slope stabilization due to their adaptability and cost-effectiveness.

39. The load on a square footing 2 m × 2 m resting on a deep deposit of clay is 600 kN. If the unconfined compressive strength of clay is 100 kN/m², the failure occurs at 20% of strain for Terzaghi's influence factor $I_t = 0.95$, and Poisson's ratio of soil $\nu = 0.5$, the average immediate settlement will be nearly
(a) 34 cm (b) 43 cm
(c) 52 cm (d) 61 cm

39. Ans: (b)

Sol: $S_i = \frac{q}{E_S} B(1-\mu^2) I_f$

$q = \frac{600}{2\times2} = 150$ kN/m², B = 2 m, $\mu = 0.5$

$I_f = 0.95$

$E_S = \frac{\sigma}{\varepsilon} = \frac{100}{0.2} = 500$ kN/m²

On substitution in the above formula, we get

$S_i = 0.4275$ m $= 42.75$ cm

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40. A well foundation of 6 m external diameter and of 5 m internal diameter is sunk to a depth of 15 m in a deep deposit of sand. If the average N value of sand is 20, the load that the well can carry by bearing alone will be nearly

(a) 52 MN (b) 44 MN
(c) 38 MN (d) 29 MN

40. Ans: (c)

Sol: As per IS:3955, the allowable bearing pressure (q_a) is obtained as follows for the well foundations.

$q_a = 0.054\ N^2B + 0.16\ (100 + N^2).\ D_f$

where q_a ..... in kN/m^2

Given: N = 20, B = 6 m, D_f = 15 m

$q_a = 0.054 \times 20^2 \times 6 + 0.16\ (100 + 20^2)\ 15$

$= 1329.6\ kN/m^2 = 1.3296\ MN/m^2$

The allowable load = Area of the base × q_a

$= \frac{\pi}{4} \times 6^2 \times 1.3296 = 37.6\ MN$

41. A sheet pile wall or bulkhead may be subjected to which one of the following types of lateral pressures?

(a) Active and passive earth pressure
(b) Vertical pressure due to ship impact
(c) Balanced water pressure
(d) Inclined wind pressure

41. Ans: (a)

Sol: A sheet pile wall or bulkhead is primarily subjected to active and passive earth pressure, which results from soil movement and resistance. These pressures influence the stability and design of the structure

42. What is the maximum depth to which a trench of vertical sides can be excavated in a clay stratum with c = 50 kN/m^2, γ =16 kN/m^3, $\beta = 90°$, $\phi = 0°$, F_c = 1 and N = 0.261?

(a) 12 m (b) 14 m
(c) 16 m (d) 18 m

42. Ans: (a)

Sol: $H = \frac{C}{S_n \gamma . F_C}$

$= \frac{50}{0.261 \times 16 \times 1} = 12\ m$

43. The reinforced soil technique/concept is essentially based on the mobilization of the interfacial shearing resistance between the soil and reinforcement which in turn restrains the

(a) shear force
(b) shearing resistance
(c) lateral deformation of the soil
(d) longitudinal deformation of the soil

43. Ans: (c)

Sol: The reinforced soil technique relies on the interfacial shearing resistance between the soil and reinforcement to enhance stability. This resistance primarily restrains lateral deformation of the soil, preventing excessive movement and improving structural integrity.

44. Which one of the following is an example of reinforced earth wall?

(a) Facing panel with wire mesh reinforcement
(b) Hollow panel with tieback anchor
(c) Unanchored gabion wall
(d) PFRC wall

44. Ans: (a)

Sol: The different types of Reinforced earth walls in use are:

1. Facing panels with wire mesh reinforcement.
2. Facing panels with metal strip reinforcement
3. Solid panels with tieback anchors
4. Anchored Gabion walls
5. Anchored crib walls
6. Geotextile Reinforced walls etc...

45. To keep the surveying instruments in fit condition
   (a) the instrument should be removed from and placed quickly in the box
   (b) the tripod legs should be set too close to each other and should be planted firmly on the ground
   (c) when the magnetic needle of the instrument is in use, it should be raised off the pivot
   (d) the objective and eyepiece lens should not be touched with fingers

45. Ans: (d)

Sol: (a) If the instrument is moved quickly, it increases the risk of damage.
(b) If tripod legs are kept too close enough stability may not be achieved.
(c) The magnetic needle should rest on the pivot for free movement.

46. Which one of the following data is not required for design of a weir or a barrage?
   (a) High flood level for the river at the weir site
   (b) Maximum flood discharge for the river at the weir site
   (c) River cross-section at the weir site
   (d) Discharge of the river

46. Ans: (d)

Sol: The design of a weir or barrage primarily depends on factors such as flood levels, maximum flood discharge, and the river cross-section at the site.

47. In case of design of a weir or a barrage by providing a higher afflux, the waterway and, therefore, the length of the weir can be reduced, but it will result in
   (a) increased cost of training works
   (b) reduced risk of failure by outflanking
   (c) reduced scour
   (d) reduced discharge intensity

47. Ans: (a)

Sol: When designing a weir or barrage with a higher afflux, the reduced waterway and length of the structure lead to increased velocity and turbulence. Among the given options, the correct answer is: (a) increased cost of training works.

48. In case of irrigation canal, the seepage losses depend upon
   (a) the condition of the canal; the seepage through a silted canal is more than that from a new canal
   (b) amount of silt carried by the canal; the less the silt, lesser are the losses
   (c) velocity of canal water; the more the velocity, the more will be the losses
   (d) cross-section of the canal and its wetted perimeter

48. Ans: (d)

Sol: The seepage losses in an irrigation canal primarily depend on (d) cross-section of the canal and its wetted perimeter.

49. Which one of the following is not the way of alignment of canals?
(a) Watershed canal
(b) Contour canal
(c) Distribution canal
(d) Side slope canal

49. Ans: (c)

Sol: A distribution canal is not a type of canal alignment; rather, it is a canal that distributes water to fields or minor canals. Canal alignment types typically refer to how a canal is laid out in relation to terrain and water flow. The other options—watershed canal, contour canal, and side slope canal—are valid types of canal alignments based on geographical and topographical considerations.

50. Which one of the following is one of the objectives of the river training?
(a) To make the river change its course
(b) To protect the river banks by deflecting the river away from the attacked banks
(c) To avoid disposal of sediment load
(d) To avoid providing minimum water depth required for navigation

50. Ans: (b)

Sol: River training is designed to manage and stabilize the flow of a river to prevent erosion and minimize damage to nearby infrastructure and land. One of its key objectives is to protect riverbanks by guiding the river's flow, reducing its aggressive attack on vulnerable areas, and ensuring controlled movement.

51. While laying or designing the water distribution system, attempts should be made to keep the
(a) sewer lines and waterlines as far away as possible
(b) sewer lines above the waterlines
(c) sewer lines exactly below the waterlines
(d) sewer lines and waterlines close to each other

51. Ans: (a)

Sol: (preferably > 3 m apart)

52. Which one of the following factors should be kept in view while fixing the design period for waterworks?
(a) Funds available for the completion of the project; if more funds are available, the design period shall be more
(b) Life of the pipe and other structural materials used in the water supply scheme
(c) As far as possible the design period should be longer than life of materials used in the water supply scheme
(d) Rate of interest on the loans taken to complete the project; if it is more, it will be good to keep design period more

52. Ans: (b)

Sol: Both life time & economy to be considered

53. Which one of the following is the function of the Central Board set up by the Government of India for water pollution prevention?
(a) To carry out the river surveys for classification
(b) To help and provide research facilities in connection with the water pollution control

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(c) To provide and arrange training facilities to the people connected with the water pollution control

(d) To lay down the water purification standards

53. Ans: (b)

54. Which of the following measures is/are to be adopted against the water pollution?

1. The sewage before discharging into the water body may need not be treated
2. The industrial waste should not be treated before disposing it off
3. As far as possible water sources should not be used for discharging the sewage

Select the correct answer.

(a) 1, 2 and 3 (b) 1 only

(c) 3 only (d) 1 and 2 only

54. Ans: (c)

Sol: To effectively combat water pollution, proper treatment of sewage and industrial waste is essential before disposal. Based on this, statements 1 and 2 are incorrect, as untreated waste can severely harm aquatic ecosystems and human health.

However, statement 3 is correct, as avoiding direct discharge of sewage into water sources helps maintain water quality.

55. Which one of the following is one of the objects of water treatment?

(a) To detect the dissolved gases, murkiness and colour of water

(b) To detect the pleasant and objectionable tastes of water

(c) To kill all the pathogenic germs, which are harmful to the human health

(d) To detect the tuberculating and corrosive properties of water

55. Ans: (c)

Sol: The primary objective of water treatment is to ensure safe and clean water by removing harmful contaminants. Among the given options, the correct answer is (c) To kill all the pathogenic germs, which are harmful to human health.

Water treatment processes focus on eliminating disease-causing microorganisms through methods like chlorination, UV treatment, and filtration, making water safe for consumption.

56. Which one of the following aspects should be considered at the time of final selection of sewage treatment plant?

(a) The site should be safe from floods for all the time

(b) The site should not be situated on the leeward side of wind

(c) The site should be as far as possible far away from the town

(d) The subsoil water level at the site should not remain low even during monsoon

56. Ans: (a)

Sol: Flood safety is a crucial factor in selecting a sewage treatment plant site.

57. A completely mixed activated process is to be used to treat wastewater flow of 500 m^3 /hr having soluble BOD_5 of 250 mg/L. If the concentration of soluble BOD_5 escaping treatment is 10 mg/L, the treatment efficiency will be

(a) 82% (b) 86% (c) 92% (d) 96%

57. Ans: (d)

Sol: $Q = 500\ m^3/hr$

$BOD_{5_i} = 250\ mg/L$

$BOD_{5_e} = 10\ mg/L$

$$\eta = \frac{BOD_i - BOD_e}{BOD_i} \times 100$$

$$= \frac{250 - 10}{250} \times 100 = 96\ \%$$

58. The land treatment of sewage is suitable, when
(a) the overall rainfall is very high
(b) there is no river or natural water course
(c) the quantity of sewage is less
(d) rivers usually run full during summer

58. Ans: (b)

Sol: To avoid contamination due to overflow into rivers.

59. The excessive acidity or alkalinity of the particular wastewater is neutralized by adding alkali or acid and this is achieved in
(a) the sedimentation tank
(b) the equalization tank
(c) the flocculation tank
(d) the purification tank

59. Ans: (b)

Sol: Equalization tank is provided before sending sewage to biological treatment to equalize the flow & properties of sewage.

60. Which one of the following is an aerobic method of decomposing solid waste?
(a) Sanitary landfill (b) Composting
(c) Incineration (d) Open dumping

60. Ans: (c)

Sol: Incineration is in presence of oxygen only (aerobic).

61. A circular disc 3 m in diameter is held normal to a 26.4 m/s wind of density 1.2 kg/m^3. If the coefficient of drag of disc is 1.1, the force required to hold it at' rest will be nearly
(a) 1.25 kN (b) 2.5 kN
(c) 3.25 kN (d) 4.2 kN

61. Ans: (c)

Sol: $F_D = C_D.A\frac{1}{2}\rho u^2$

$$= C_D.\frac{\pi D^2}{4}.\frac{1}{2}\rho u^2$$

$$= 1.1\times\frac{\pi(3)^2}{4}\times\frac{1}{2}\times1.2\times26.4^2$$

$F_D = 3.25\ kN$

62. The phenomenon of sudden rise in pressure in the pipe is known as
(a) pressure rise
(b) water hammer
(c) stream function
(d) hydraulic gradient

62. Ans: (b)

Sol: The rise in pressure due to closure of valve is known as water hammer.

63. What is the discharge through the venturi flume built in a rectangular channel 1 m wide and having its throat width 0.4 m? The upstream head is 0.57 m, measured head in throat is 0.5 m and the value of C_d is 1.
(a) 210 L/s (b) 230 L/s
(c) 250 L/s (d) 270 L/s

63. Ans: (b)

Sol: $A_C = 0.4 \times 0.5 = 0.2\ m^2$

$Q = C_d A \sqrt{2g(H_1 - H_2)}$

$= 1 \times 0.2 \times \sqrt{2 \times 9.81(0.57 - 0.5)}$

$= 0.234\ m^3/s$

$= 230\ L/s$

64. In a long pipe, when the flowing water is suddenly brought to rest by closing the valve or by any similar cause, there will be a sudden rise in pressure. The magnitude of pressure rise depends on

(a) the speed at which the valve is opened

(b) the velocity of flow

(c) the diameter of the pipe

(d) the thickness of the pipe wall

64. Ans: (b)

Sol: During sudden closure

$P = \rho CV$

During gradual closure

$P = \frac{\rho VL}{T_a}$

In both cases P = f(V).

65. A spherical object of 1.45 m diameter is completely immersed in a water reservoir and chained to the bottom. If the chain has a tension of 5.2 kN, the weight of the object when it is taken out of the reservoir into the air will be nearly

(a) 15.5 kN

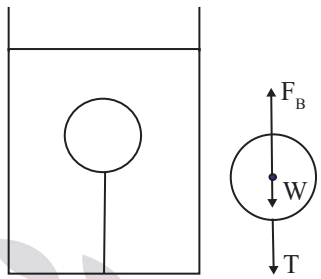
(b) 12.5 kN

(c) 10.5 kN

(d) 7.5 kN

65. Ans: (c)

Sol:



$\Sigma F_y = 0$

$F_B = W + T$

$W = F_B - T$

$= \frac{\gamma_w \pi D^3}{6} - T$

$= \frac{9.81 \times \pi \times 1.45^3}{6} - 5.2$

$W = 10.5\ kN.$

66. A double-acting reciprocating pump having piston area 0.1 m^2 has a stroke 0.30 m long. If the pump is discharging 2.4 m^3 of water per minute at 45 r.p.m. through a height of 10 m, the power required to drive the pump will be nearly

(a) 4.98 KW (b) 4.86 kW

(c) 4.64 kW (d) 4.42 kW

66. Ans: (d)

Sol: $P_{th} = \rho g Q_{th} H$

$= \rho g \times \frac{ALN}{30} \times H$

$= 9810 \times \frac{0.1 \times 0.3 \times 45}{30} \times 10$

$= 4.41\ kW$

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67. A centrifugal pump is required to lift water to a total head of 40 m at the rate of 50 L/s. If its overall efficiency is 62%, the power required for the pump will be
(a) 25.6 kW (b) 28.4 kW
(c) 31.6 kW (d) 34.4 kW

67. Ans: (c)

Sol: $P = \frac{\rho g Q H}{\eta} = \frac{9810 \times 50 \times 10^{-3} \times 40}{0.62} = 31.65\ kW$

68. Full load is supplied by the turbine shaft when the diameter of jet issuing from the nozzle is 150 mm. If the load suddenly drops to 36% of the full load, the jet diameter to regulate the speed will be
(a) 75 mm (b) 80 mm
(c) 85 mm (d) 90 mm

68. Ans: (d)

Sol: $P = \eta_0 \rho g Q H$

$$P = \eta_0 \rho g \times \left(\frac{\pi}{4} \times d^2\right) \times C_v \sqrt{2gH} \times H$$

$$P \propto d^2$$

$$\frac{P_2}{P_1} = \left(\frac{d_2}{d_1}\right)^2$$

$$0.36 = \left(\frac{d_2}{d_1}\right)^2$$

$$\Rightarrow d_2 = 0.6 \times d_1$$

$$= 0.6 \times 150$$

$$= 90\ mm$$

69. What is the delta for a crop when its duty is 864 hectares/cumec on the field (the base period of this crop is 120 days)?
(a) 100 cm (b) 110 cm
(c) 120 cm (d) 130 cm

69. Ans: (c)

Sol: $\Delta = \frac{864\ B}{D}$

$$= \frac{864 \times 120}{864}$$

$$= 120\ cm$$

70. Formation of successive bends of reverse order may lead to the formation of a complete 'S' curve called
(a) bending (b) meander
(c) silting (d) scouring

70. Ans: (b)

Sol: When a river flows over an alluvial plain, the water tends to erode the banks on the outer side and deposit sediments on the inner side of bends. This natural erosion and deposition process causes the river to develop a series of reverse bends, ultimately forming an 'S'-shaped curve known as a meander.

Bending is a general term and not specific.
Silting refers to deposition of sediments.
Scouring refers to erosion of the bed or banks.
Hence, the technically and terminologically correct answer is "Meander."

71. Which one of the following is the pre-construction measure for silting control in reservoirs?
(a) Construction of check dams
(b) Removal of post-flood water
(c) Mechanical stirring of the sediment
(d) Erosion control and soil conservation

71. Ans: (d)

Sol: Pre-construction measures aim at preventing silt from entering the reservoir.

Erosion control and soil conservation in the catchment area reduces sediment load, thereby controlling reservoir silting.

Other options such as check dams and sediment stirring are more relevant as post-construction or remedial measures.

72. Which one of the following is a simple and straight forward analytical procedure for computing reservoir capacity and is used as an excellent alternative to mass curve method of determining reservoir capacity?

(a) Sequent peak algorithm (b) Inflow method
(c) Cumulative inflow (d) First peak

72. Ans: (a)

Sol: The Sequent Peak Algorithm is a widely recognized and efficient method for estimating the required reservoir storage capacity based on inflow and demand data, and is often used as an alternative to the mass curve method.

73. Which one of the following rivers is a silting river?

(a) Aggrading river (b) Degrading river
(c) Stable type river (d) Braided river

73. Ans: (a)

Sol: An aggrading river deposits more sediment than it erodes, leading to the accumulation of silt in the riverbed. Hence, it is typically referred to as a silting river.

Degrading rivers erode their bed.

Stable rivers maintain equilibrium.

Braided rivers may show aggradation, but not all braided rivers are silting rivers.

74. Rivers in alluvial flood plains which flow in zig-zag fashion are called

(a) meandering (b) aggrading
(c) degrading (d) deltaic

74. Ans: (a)

Sol: Rivers that flow in zig-zag or snake-like patterns over alluvial flood plains are termed meandering rivers. These rivers form due to the lateral erosion and deposition processes in low gradient areas.

75. All the methods of calculating crop evapotranspiration involve which one of the following relationships?

(a) $ET_c = 2K_cET_o$ (b) $ET_c = K_CET_o$
(c) $ET_c = 4K_CET_o$ (d) $ET_c = \frac{K_c}{ET_o}$

where K_c is crop coefficient, ET_o is potential evapotranspiration and ET_c is evapotranspiration of a specific crop.

75. Ans: (b)

Sol: $ET_c = K_c \times ET_o$ is the standard equation for crop evapotranspiration:

76. What is the time required to grade and finish 30 km of road formation with width equal to thrice the width of the motor grader, using six passes of the motor grader with speed for each of the successive two passes as 6 km/hr, 8 km/hr and 10 km/hr respectively?

Assume machine efficiency based on operator's skill, machine characteristics and work conditions as 75%.

(a) 78 hours (b) 84 hours
(c) 90 hours (d) 96 hours

76. Ans: (d)

Sol: Travel length for each pass = 30 × 3 km
= 90 km
Time taken for first two passes = 90 × 2 / 6
= 30 Hours
Time taken for next two passes = 90 × 2/ 8
= 22.5 Hours
Time taken for last two passes = 90 × 2/ 10
= 18 Hours
Total time needed with 100% efficiency
= 20 + 22.5 + 18 Hours
= 70.5 Hours
Total time needed with 75% efficiency
= 70.5 / 0.75 Hours
= 94 Hours

77. The factors influencing the output of a machine in construction are
1. physical site conditions,
2. condition of the machine
3. method of operation
4. type of soil
Which of the above factors are correct?
(a) 1, 2 and 3 only (b) 1, 2 and 4 only
(c) 2, 3 and 4 only (d) 1, 2, 3 and 4

77. Ans: (a)

Sol: The efficiency of any construction equipment is influenced by site conditions, machine condition, and operational methodology. However, among all types of construction equipment, only earthwork machinery is directly affected by soil conditions, while others function independently of soil characteristics.

78. Which one of the following statements is not correct in respect of network diagram for time scheduling techniques?
(a) In a network, there must be only a single node and the initial node must have only outgoing arrows.
(b) A network can have more than one final node.
(c) An event cannot occur twice, i.e., there cannot be any network path looping back to previously occurred event.
(d) An event cannot occur until all the activities leading to it are completed.

78. Ans: (b)

Sol: More than one final node is not correct

79. An interference float is defined as
(a) the amount of time by which the start of the activity may be delayed without causing a delay in the completion of the project
(b) the amount of time by which the start of the activity may be delayed without delaying start of a following activity
(c) the difference between total float and free float
(d) the amount of time by which the start of the activity may be delayed without affecting the preceding on the following activity

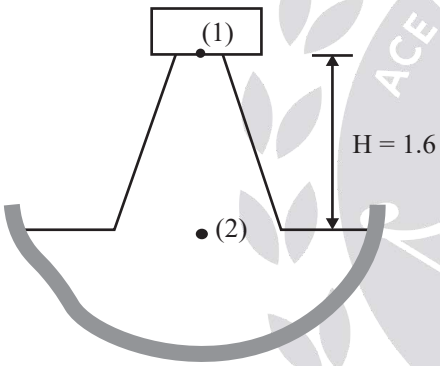
79. Ans: (c)

Sol: Interference float = Total Float – Free Float
= Slack @ head event

80. What is the approximate efficiency of a Kaplan turbine developing 3000 kW under a net head of 5 m? It is provided with a draft tube with its inlet (diameter 3 m) set 1.6 m above the tailrace level. A vacuum gauge connected to the draft tube indicates a reading of 5 m of water.
Assume draft tube efficiency as 68% and acceleration due to gravity as 10 m/s^2. Neglect head losses in draft tube.
(a) 85% (b) 90% (c) 80% (d) 95%

80. Ans: (a)

Sol:



The draft tube efficiency is given by,

$$\eta_d = \frac{\frac{V_1^2 - V_2^2}{2g} - h_{f2}}{\frac{V_1^2}{2g}} = \frac{V_1^2 - V_2^2}{V_1^2} \quad (\because h_{fd} = 0)$$

$\therefore V_1^2 - V_2^2 = 0.68\, V_1^2$

By Bernoulli's equation

$$\frac{P_1}{\rho g} + \frac{V_1^2}{2g} + Z_1 = \frac{P_2}{\rho g} + \frac{V_2^2}{2g} + Z_2$$

$$-5 + \frac{V_1^2}{2g} + 1.6 = 0 + \frac{V_2^2}{2g} + 0$$

$$\therefore \frac{V_1^2 - V_2^2}{2g} = 3.4$$

$$\frac{0.68\, V_1^2}{2 \times 10} = 3.4$$

$V_1 = 10$ m/s

$$Q = A_1 V_1 = \frac{\pi}{4} \times 3^2 \times 10 = 70.68 \backsimeq 70 \text{ m}^3/\text{s}$$

$$\eta = \frac{P}{\rho g Q H} = \frac{3000 \times 10^3}{10 \times 10^3 \times 70 \times 5} = 0.857$$

81. Any cause which is beyond the control of the contractor or the owner, as the case may be, which they could not foresee or a reasonable amount of diligence could not have foreseen and which substantially affects the performance of the contract, is called
(a) letter of intent (b) liquidated damage
(c) force majeure (d) warranty period

81. Ans: (c)

Sol: **Letter of Intent:** It outlines the terms and conditions between client and contractor.
Liquidated damage: Predetermined amount of money against any kind of breaches.
Force Majeure: It is a situation beyond the control such as natural disasters.
Warranty Period: Time frame in which the warranty is valid and provides coverage for any damages/defects in materials and workmanship.

82. A point beyond which the project duration cannot be reduced irrespective of the increase in direct cost is known as
(a) normal duration
(b) optimum duration
(c) pessimistic duration
(d) crash duration

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Rank 1 (EE)

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CLASSROOM COACHING
Selected in: Transport, R&B Dept., Govt. of TG.

RANK 1 CE
Venkat Reddy
MEGA MOCK TEST
Selected in Public Health, MA & UD Dept. Govt. of TG.

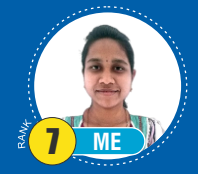
RANK 3 EE
Devarakonda Sathwik
CLASSROOM COACHING
Selected in Transport, R&B Dept., Govt. of TG.

RANK 4 EE
Sangem Ravi Kumar
CLASSROOM COACHING
Selected in Transport, R&B Dept., Govt. of TG.

RANK 4 CE
Makam Jeevan Kumar
CLASSROOM COACHING
Selected in Public Health, MA & UD Dept., Govt. of TG.

RANK 6 CE
Balraj Madgan
MEGA MOCK TEST
Selected in Transport, R&B Dept., Govt. of TG.

RANK 7 EE
Challabotla Saikiran
CLASSROOM COACHING
Selected in Transport, R&B Dept., Govt. of TG.



RANK 7 ME
Vineetha Boddula
CLASSROOM COACHING
Selected in Irrigation & CAD Dept., Govt. of TG.

RANK 7 CE
Rama Krishna
CLASSROOM COACHING
Selected in Transport, R&B Dept., Govt. of TG.

RANK 8 CE
Abhinav Karimilla
CLASSROOM COACHING
Selected in Transport, R&B Dept., Govt. of TG.

RANK 9 EE
Ganapathi G
CLASSROOM COACHING
Selected in Transport, R&B Dept., Govt. of TG.

RANK 9 CE
Pranay V
CLASSROOM COACHING
Selected in Public Health, MA & UD Dept., Govt. of TG.

RANK 11 EE
Sainath
CLASSROOM COACHING
Selected in Irrigation & CAD Dept., Govt. of TG.

RANK 11 CE
Bhugolla Surya Teja
CLASSROOM COACHING
Selected in Transport, R&B Dept., Govt. of TG.

RANK 12 EE
Veligeti Umesh
CLASSROOM COACHING
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RANK 12 CE
Puli Naveen Reddy
CLASSROOM COACHING
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RANK 14 ME
Ravi Teja
CLASSROOM COACHING
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RANK 15 ME
M Dheeraj Reddy
CLASSROOM COACHING
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RANK 16 EE
Jangili Rajashekar
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RANK 18 EE
Malka Kiran
CLASSROOM COACHING
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RANK 19 EE
Sowmya
CLASSROOM COACHING
Selected in Irrigation & CAD Dept., Govt. of TG.

RANK 20 CE
Md. Azmatullah
MEGA MOCK TEST
Selected in Transport, R&B Dept., Govt. of TG.

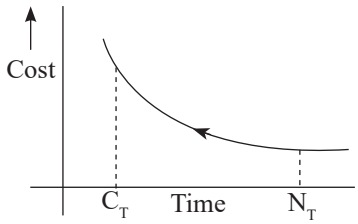
AND MANY MORE..

500+ SELECTIONS

CE : 434 | EE : 61 | ME : 20

82. Ans: (d)

Sol:



C_T = Crash time
N_T = Normal Time

Crash duration is the minimum time for the project duration and it becomes lower limit. The project duration cannot be reduced less than the crash duration even though we spend money.

83. Which one of the following models has not been found to be of much practical value in the construction industry?
(a) Game theory model
(b) Friedman's model
(c) Gates model
(d) Cash flow-based model

83. Ans: (a)

Sol: **Game Theory Model:** It is a mathematical model used for deciding the bidding strategies. It uses probability theory hence the outcome is purely based on knowledge and intuition.

84. Which one of the following reasons is not correct for low labour productivity?
(a) Unproductive time
(b) Workers high morale
(c) Poor pre-work preparation by supervisors
(d) Directional failures of the project management

84. Ans: (b)

Sol: Workers high morale leads to high productivity.

85. Consider the following basic causes of accidents in civil engineering works :
1. Persons/materials falling from height
2. Persons being struck or trapped by moving objects
3. Persons stepping on or striking against objects
Which of the above causes are correct?
(a) 1, 2 and 3 (b) 1 and 2 only
(c) 2 and 3 only (d) 1 and 3 only

85. Ans: (a)

Sol: **Basic Causes of Accidents:**
1. Persons/objects falling from height.
2. Persons being struck (or) trapped by moving objects.
3. Tripping hazards such as debris and uneven surfaces
4. Defective equipment
5. Fire and explosions

86. Which one of the following Acts covers provision for daily working hours, holidays and overtime payments?
(a) The Minimum Wages Act
(b) The Payment of Wages Act
(c) The Factories Act
(d) The Trade Unions Act

86. Ans: (c)

Sol: **The Minimum Wages Act:** It mandates minimum wage rates and empowers both central and state governments to fix up minimum wages for employees.
The payment of wages Act: It aims to ensure regular and timely payment of wages and prevents the unauthorized penalties/fines.

The Factories Act: It covers the provision for daily working hours holidays and over time payments. It provides a fair and decent payment system to employees.

The Trade Union Act: It provides to establish a trade union to enable collective bargaining.

87. What is the depth of a point below water surface in sea where pressure intensity is 1.006 MN/m^2 and the specific gravity of seawater is 1.025?

(a) 70 m (b) 80 m
(c) 90 m (d) 100 m

87. Ans: (d)

Sol: $P = \rho g H$

$\Rightarrow H = \frac{P}{\rho g}$

$\Rightarrow H = \frac{1006 \times 10^3}{1025 \times 9.81}$

$H = 100$ m.

88. Which one of the following pressure gauges is most accurate device and is used for precision work and calibrating other pressure gauges?

(a) Dead weight pressure gauge
(b) Diaphragm pressure gauge
(c) Bourdon tube pressure gauge
(d) Vacuum pressure gauge

88. Ans: (a)

Sol: The dead weight pressure gauge is considered the most accurate device for precision work and calibration of other pressure gauges. It operates based on fundamental physics principles, using calibrated weights to apply a known force on a fluid, ensuring highly precise pressure measurements.

89. Water is flowing through a pipe of 5 cm diameter under a pressure of 29.43 N/cm^2 (gauge) and with mean velocity of 2 m/s. What is the total head of the water at a cross-section, which is 5 m above the datum line? Take the density of water as 1000 kg/m^3.

(a) 38.2 m (b) 35.2 m
(c) 32.6 m (d) 28.6 m

89. Ans: (b)

Sol: $H = \frac{P}{\rho g} + \frac{V^2}{2g} + z$

$H = \frac{29.43 \times 10^4}{9.81 \times 10^3} + \frac{2^2}{2 \times 9.81} + 5$

$H = 35.2$ m of water

90. Pitot tube is one of the most accurate devices for

(a) pressure measurement
(b) velocity measurement
(c) density measurement
(d) surface tension measurement

90. Ans: (b)

Sol: The Pitot tube is widely recognized for its accuracy in velocity measurement. It operates based on Bernoulli's principle, measuring the difference between stagnation pressure and static pressure to determine fluid velocity.

91. The buckling of the web by diagonal compression can be prevented by which of the following?

1. The depth to thickness ratio of web can be increased
2. Web stiffness may be provided forming panels to increase the shear resistance of the web
3. Web stiffness may be provided forming panels in such a way as to create tension field action in the web to resist diagonal compression

Select the correct answer.
(a) 1 and 2 only (b) 2 and 3 only
(c) 1 and 3 only (d) 1, 2 and 3

91. Ans: (b)

Sol: The diagonal compression resulting from shear causes the web to buckle. Therefore, shear buckling of plate girder web occurs largely due to compressive stresses acting diagonally within the web. This problem can be addressed in one of three ways.

1. The depth to thickness ratio of the web can be made small enough so that the problem is eliminated.
2. Web stiffeners can be used to form panels with increased shear strength.
3. Web stiffeners can be used to form panels that resist the diagonal compression through tension field action.

92. It is proposed to design an industrial building 12 m high for a 50-year life. The building size is in the range 20 m to 50 m, the topography of the site is practically plain and the terrain is in the city industrial area. If the risk coefficient $k_1 = 1$, terrain factor $k_2 = 0.9$, topography factor $k_3 = 1$ and wind speed $V_b = 47$ m/s, the design wind pressure at the site will be nearly
(a) 0.6 kN/m^2 (b) 1.1 kN/m^2
(c) 2.1 kN/m^2 (d) 2.6 kN/m^2

92. Ans: (b)

Sol: Design wind pressure $(P_d) = 0.6\, V_z^2$
Design wind speed $(v_z) = k_1 \times k_2 \times k_3 \times v_b$
Where,
v_b is basic wind speed = 47 m/s
$P_d = 0.6\,(1 \times 0.9 \times 1 \times 47)^2$
$= 1073.57$ N/m^2 $= 1.073$ kN/m^2 ≈ 1.1 kN/m^2

93. The ultimate tensile strain in steel is
(a) 5-15 times more strain than concrete at collapse
(b) 15-25 times more strain than concrete at collapse
(c) 25-35 times more strain than concrete at collapse
(d) 35-45 times more strain than concrete at collapse

93. Ans: (d)

94. The long-term deflections of reinforced concrete members under sustained loads are mainly due to
1. differential shrinkage
2. creep under sustained loading
3. temperature effects
Select the correct answer.
(a) 1 and 2 only (b) 1 and 3 only
(c) 2 and 3 only (d) 1, 2 and 3

94. Ans: (d)

Sol: Long term deflection of RC beams are due to
- Shrinkage of concrete
- Creep of concrete
- Temperature change

95. The maximum spacing of vertical stirrups at beam ends (plastic hinge locations) as per IS 13920 is the lesser of
(a) 0.75d or 300 mm (b) 0.55d or 250 mm
(c) 0.35d or 200 mm (d) 0.15d or 150 mm

95. Ans: (*)

Sol: As per IS 456: 2000 Maximum spacing of vertical stirrups should not be more than 0.75d (or) 300 mm
As per IS 13920: Maximum spacing of vertical stirrups should not be more than 0.25d (or) 100 mm.

Hearty Congratulations

To our students CIVIL ENGINEERING

Selected in SSC JE - 2024

HARSHIT KHARE
Roll No. 3008100089
Selected in: **CPWD**

RAMSWRUP
Roll No. 2404100567
Selected in: **CPWD**

LAKSHIT BHARDWAJ
Roll No. 3206106390
Selected in: **CPWD**

M V SIVA RAM REDDY
Roll No. 8008101372
Selected in: **CPWD**

RAVINDRA DHAKAD
Roll No. 6005100485
Selected in: **CPWD**

RAHUL KUMAWAT
Roll No. 2401100340
Selected in: **CPWD**

VISHAL SINGH
Roll No. 3013105309
Selected in: **MES**

S R JAFFER SHARIEF
Roll No. 8006102160
Selected in: **MES**

BEHARA SRIKANTH
Roll No. 8007102883
Selected in: **MES**

ANIRUDH KOTIYAL
Roll No. 2003101448
Selected in: **MES**

FAIZAN AHMAD
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Selected in: **MES**

AMBATI NAGA SRI SAI
Roll No. 8601105973
Selected in: **MES**

BHASKAR SHARMA
Roll No. 2201112287
Selected in: **MES**

SRINI VASA RAO
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Selected in: **MES**

PIJUSH AKHULI
Roll No. 4426100222
Selected in: **MES**

ABHIMANU KUMAR
Roll No. 3205100298
Selected in: **MES**

NIMESH SINGH
Roll No. 2201114868
Selected in: **MES**

LALAM RAMU NAIDU
Roll No. 8601102319
Selected in: **MES**

GYANENDRA KUMAR
Roll No. 2201110803
Selected in: **CWC**

ADARSH AGRAHARI
Roll No. 3003100031
Selected in: **BRO**

REDDI SANNIBABU
Roll No. 8007102353
Selected in: **MES**

KONAPALA MANOJ
Roll No. 2201109855
Selected in: **MES**

SUNIL SHARMA
Roll No. 4415100648
Selected in: **MES**

RINKESH KUMAR
Roll No. 6204103361
Selected in: **MES**

& many more..

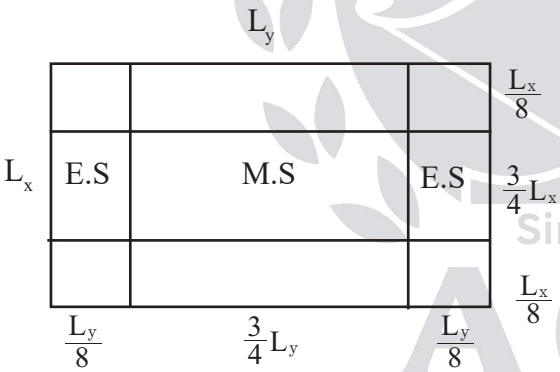
Total 150+ Selections | **CE-98** | **EE-29** | **ME-24**

96. Which of the following are the design steps of restrained slabs?
1. Slabs are considered as divided in each direction into middle strips and edge strips
2. The middle strips are one-fourth of the width and edge strips are three-quarters of the width
3. Tension reinforcement provided at mid-span in the middle strip shall extend in lower part of the slab to within $0.25l$ of continuous edge or $0.15l$ of a discontinuous edge, where l is the length of the span

Select the correct answer.
(a) 1 and 3 only (b) 1 and 2 only
(c) 2 and 3 only (d) 1, 2 and 3

96. Ans: (a)

Sol:



Width of middle strip is $\frac{3}{4}^{th}$ of span

Width of edge strip is $\frac{1}{8}^{th}$ of span

97. Which of the following are the correct design requirements regarding under- ground water tanks?
1. Walls are to be designed for saturated soil up to the extent of water above the base slab
2. Base slab is to be designed for the net uplift pressure of water (less weight of slab for tank empty)
3. Check has to be applied for stability of the tank as a whole against uplift

Select the correct answer.
(a) 1 and 2 only (b) 1 and 3 only
(c) 2 and 3 only (a) 1, 2 and 3

97. Ans: (d)

Sol:

- Underground water tank walls are designed considering saturated soil pressure upto the water level.
- The base slab of underground water tank needs to be designed to resist uplift pressure.
- Check required for stability of the tank against up-lift.

98. Which of the following characteristics are useful in the yield line patterns for slab with various boundary conditions?
1. Yield lines are curvilinear lines so that they may act as plastic hinges
2. Yield lines terminate at the slab boundary or at intersection of other yield lines
3. Yield lines may form along the support if an edge is fixed or continuous

Select the correct answer.
(a) 1 and 2 only (b)1 and 3 only
(c) 2 and 3 only (d) 1, 2 and 3

98. Ans: (c)

Sol:

- Yield lines are straight lines that represent the axis of rotation in a slab under load.

- Yield lines end at slab boundaries.
- Negative yield lines occur at support in addition to positive yield lines.

99. For cohesionless sand at a depth of 6 m and with an angle of internal friction of 30°, the active lateral pressure intensity will be (take unit weight of dry sand as 19600 N/m^3)

(a) 43.4 kN/m^2 (b) 39.2 kN/m^2
(c) 36.4 kN/m^2 (d) 33.2 kN/m^2

99. Ans: (b)

Sol: Active lateral earth pressure intensity at 6 m

$$P_a = K_a \gamma H$$

$$= \left(\frac{1-\sin\phi}{1+\sin\phi}\right)\gamma H$$

$$= \left(\frac{1-\sin 30}{1+\sin 30}\right) \times 19.6 \times 10^3 \times 6$$

$$= \frac{1}{3} \times 19.6 \times 10^3 \times 6$$

$$= 39.2 \times 10^3 \text{ N/m}^2 = 39.2 \text{ kN/m}^2$$

100. A slab having total thickness 120 mm is provided reinforcement bars of following diameters. The permissible diameter is

(a) 15 mm (b) 16 mm
(c) 18 mm (d) 19 mm

100. Ans: (b)

Sol: As per IS 456-2000 the maximum diameter of bar used in slabs is one eight of thickness of slab

$$\phi_{max} \not> \frac{D}{8}$$

$$\not> \frac{120}{8}$$

$$\not> 15 \text{ mm}$$

However use 16 mm diameter bars (15 mm dia bars not available)

101. The correct sequence of the stages for dressing of stone is

(a) planning, sizing, shaping, finishing, polishing
(b) sizing, planning, shaping, finishing, polishing
(c) planning, shaping, sizing, finishing, polishing
(d) sizing, shaping, planning, finishing, polishing

101. Ans: (d)

Sol: The correct sequence of stages of dressing of stones is

Sizing, Shaping, Planning, Finishing and Polishing.

102. The short-term static modulus of elasticity E_C for structural concrete defining the slope of the tangent to the stress-strain diagram may be estimated from

(a) $2000\sqrt{f_{ck}}$ MPa (b) $3000\sqrt{f_{ck}}$ MPa
(c) $4000\sqrt{f_{ck}}$ MPa (d) $5000\sqrt{f_{ck}}$ MPa

where f_{ck} is the characteristic compressive strength of concrete.

102. Ans: (d)

Sol: As per IS 456-2000, the static modulus of elasticity of concrete

$$E_C = 5000\sqrt{f_{ck}}$$

103. The stone masonry construction is superior to brick masonry construction under which of the following circumstances?

1. Stone masonry construction can be developed aesthetically more sound than brickwork
2. Stone masonry is more watertight than brick masonry, because of the fact that bricks absorb moistures from the atmosphere

3. For public buildings and monumental structures, stone masonry provides a solid appearance and is found to be more useful than brick masonry

Select the correct answer.

(a) 1 and 2 only (b) 1 and 3 only
(c) 2 and 3 only (d) 1, 2 and 3

103. Ans: (d)

Sol: All the three statements are correct.

104. Consider the following statements :
The wall thickness depends upon
1. the anticipated load to come on the wall
2. the quality of wall material
3. the overall height of the wall
4. the height between floors
5. the spacing between buttress and cross-wall

Which of the above statements are correct?

(a) 1, 2, 3, 4 and 5
(b) 1, 2, 3 and 4 only
(c) 1, 2, 3 and 5 only
(d) 2, 3, 4 and 5 only

104. Ans: (a)

Sol: The thickness of a wall is influenced by several factors, including structural loads, material quality, building height, and spacing between structural elements

105. Grader may be used for the following works, except
(a) finishing or levelling earthwork
(b) shaping bank slopes
(c) heavy excavation
(d) dirt road maintenance

105. Ans: (c)

Sol: Graders are precision equipment primarily used for levelling and finishing surfaces, maintaining dirt and gravel roads and creating smooth slopes or grading. However, heavy excavation involves the removal of large volumes of earth, typically using equipment like excavators, dozers and backhoes. Graders are not designed for such heavy-duty digging or excavation tasks.

106. In a fixed beam subjected to downward loads, the maximum bending moment is given by the greater fixing moment. This is true
(a) if load is only central point load
(b) if load is only eccentric point load
(c) if load is only distributed load
(d) for any combination of downward loads

106. Ans: (d)

Sol: For any combination of downward (gravity) loading in fixed beams, maximum bending moment occurs at supports only.

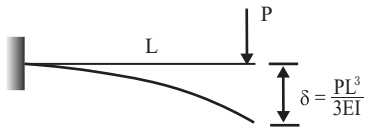
107. The deflection δ at the free end of a cantilever is

(a) $\frac{PL^2}{2EI}$ (b) $\frac{PL^3}{3EI}$
(c) $\frac{PL^3}{2EI}$ (d) $\frac{PL^2}{3EI}$

where P is point load at the free end, EI is flexural rigidity and L is length of the cantilever.

107. Ans: (b)

Sol:



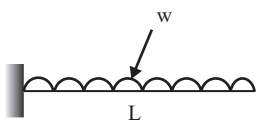
108. A cantilever beam of span L is subjected to uniformly distributed load of intensity W. If the flexural rigidity is EI, the slope θ and deflection δ at the free end are respectively

(a) $-\frac{WL^3}{8EI}$ and $-\frac{WL^4}{8EI}$ (b) $-\frac{WL^3}{6EI}$ and $-\frac{WL^4}{6EI}$

(c) $-\frac{WL^3}{8EI}$ and $-\frac{WL^4}{6EI}$ (d) $-\frac{WL^3}{6EI}$ and $-\frac{WL^4}{8EI}$

108. Ans: (d)

Sol:



$y_{max} = \frac{wL^4}{8EI}$; $\theta_{max} = \frac{wL^3}{6EI}$

109. The strain energy U due to bending is

(a) $\int\left(\frac{M^2.dx}{2EI}\right)$ (b) $\int\left(\frac{M.dx}{3EI}\right)^2$

(c) $\int\left(\frac{M^2.dx}{3EI}\right)$ (d) $\int\left(\frac{M.dx}{2EI}\right)^2$

where M is bending moment, EI is flexural rigidity and dx is short length of beam.

109. Ans: (a)

Sol: Strain energy due to BM = $\int\frac{M^2dx}{2EI}$

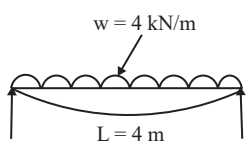
110. A rectangular beam 150 mm × 240 mm deep is simply supported at the ends on a span of 4 m and carries a uniformly distributed load of 4 kN /m on the whole span. What is the point load at the centre it should carry so that the maximum deflection is doubled?

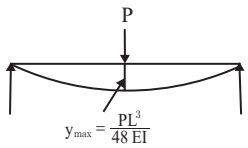
(a) 24 kN (b) 20 kN

(c) 16 kN (d) 12 kN

110. Ans: (b)

Sol:





$y_{max} = \frac{5wL^4}{384\,EI}$ $y_{max} = \frac{PL^3}{48EI}$

$= \frac{5(4)(L)(L^3)}{384\,EI} \rightarrow$ (where L = 4 m)

Given condition, $2\left[\frac{(5\times4\times4)L^3}{384\,EI}\right] = \frac{PL^3}{48EI}$

$\therefore$ P = 20 kN

111. When a cable is passed over a pulley on the pier and is stayed at the back, the pier will be subjected to net horizontal force which is given by

(a) H(1 – sinα.cosecβ)

(b) H(1 – sinβ.cosecα)

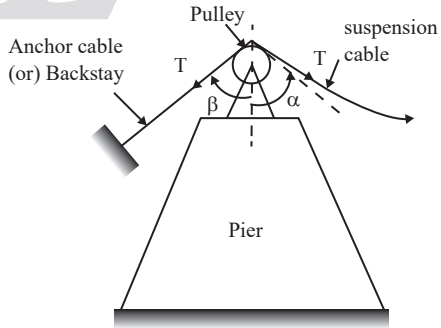
(c) H(1 + sinα.cosecβ)

(d) H(1 + sinβ.cosecα)

where H is horizontal tension in the cable, α is angle made by the cable with vertical and β is angle made by the backstay with vertical at pier.

111. Ans: (b)

Sol:



In this case, the cable at the support is passed over a guide pulley provided at the top of the supporting pier and is anchored on the other side of the pier. Hence the anchor cable is just the continuation of the suspension cable itself.

- The tension (T) in both the cables will be the same.

Net horizontal force transfered to the top of the pier = $T\sin\alpha - T\sin\beta$ $\quad (H = T\sin\alpha)$

$= H - T\sin\beta$ $\quad T = \frac{H}{\sin\alpha}$

$= H - \frac{H}{\sin\alpha} \times \sin\beta$

$= H\left[1 - \frac{\sin\beta}{\sin\alpha}\right]$ $\quad \operatorname{cosec}\alpha = \frac{1}{\sin\alpha}$

$= H\,[1 - \operatorname{cosec}\alpha \sin]\beta$

112. Which one of the following statements is not correct?
(a) In elastic theory of design, stresses in the structures under working load are less than the allowable working stress.
(b) Theory of elasticity will be best suited for structural analysis at the time of failure.
(c) Elastic method does not provide a uniform overload capacity for all parts of the structures.
(d) The ultimate load design method is more economical than elastic design method.

112. Ans: (b)

Sol: Incorrect statement is (b)

Theory of elasticity is not suitable for structural analysis at the time of failure. For this condition the best suited method is limit state method of design.

113. A steel chimney 3 m in diameter is situated in a region where the intensity of uniform wind pressure is 1200 N/m^2. If the shape factor is 0.7 and the intensity of wind pressure is uniform, the shear due to wind load at a level of 15 m below the top of the chimney will be
(a) 37.8 kN (b) 34.6 kN
(c) 31.8 kN (d) 27.6 kN

113. Ans: (a)

Sol: The shear due to wind load at a certain level of the chimney can be calculated by considering the wind pressure acting on the projected area of the chimney above that level.

Projected area of the chimney (A) = $d \times h$
$= 3 \times 15$
$= 45\ m^2$

Total wind force (F) = $p \times C_s \times A$
$= 1200 \times 0.7 \times 45$
$= 37800\ N$
$= 37.8\ kN$

The shear due to wind load at a level of 15 m below the top of the chimney is 37.8 kN

114. With regard to beams in structure, what are joists?
(a) Usually indicate a major beam frequently at wide spacing that supports small beams
(b) Closely spaced beams supporting the floors and roofs of building
(c) Roof beams usually supported by trusses
(d) Roof beams usually supported by purlins

114. Ans: (b)

Sol: **Joist:** A beam supporting floor construction but not a major beam.

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& mamy more....

115. The design strength of a tension member due to the net section rupture for plates and threaded rods is

(a) $\frac{1.2A_n f_u}{\gamma_{m1}}$ (b) $\frac{0.9A_n f_u}{\gamma_{m1}}$

(c) $\frac{0.6A_n f_u}{\gamma_{m1}}$ (d) $\frac{0.3A_n f_u}{\gamma_{m1}}$

where A_n is net effective area of cross section, f_u is ultimate strength of the material and γ_{m1} is partial safety factor.

115. Ans: (b)

Sol: The tensile strength of the plate $T_{dn} = \frac{0.9\ A_n\ f_u}{\gamma_{m1}}$

A_n = net area of plate

f_u = ultimate strength of the material

γ_{m1} = partial safety factor

116. Which one of the following checks is necessary in the design of uniaxial bending?

(a) $\frac{\sigma_{at,cal}}{0.6f_y} + \frac{\sigma_{bt,cal}}{0.66f_y} \le 1.0$

(b) $\frac{\sigma_{at,cal}}{0.6f_y} - \frac{\sigma_{bt,cal}}{0.66f_y} \le 1.0$

(c) $\frac{\sigma_{at,cal}}{0.6f_y} + \frac{\sigma_{bt,cal}}{0.66f_y} \ge 1.0$

(d) $\frac{\sigma_{at,cal}}{0.6f_y} - \frac{\sigma_{bt,cal}}{0.66f_y} \ge 1.0$

116. Ans: (a)

117. The maximum slenderness ratio λ for a member normally acting as a tie in a roof truss or a bracing system, but subject to possible reversal of stresses resulting from the action of wind or earthquake forces is

(a) 430 (b) 350 (c) 250 (d) 180

117. Ans: (b)

Sol: A member normally acting as a tie in a roof truss or a bracing system not considered effective when subjected to possible reversal of stresses resulting from the action of wind or earthquake forces.

$\lambda = 350$

118. The permissible maximum shear stress τ_{vm} for a steel beam should not exceed

(a) $0.36f_y$ (b) $0.45f_y$

(c) $0.65f_y$ (d) $0.87\ f_y$

where f_y is yield stress of steel.

118. Ans: (b)

Sol: IS 800:1984 specifies the permissible (or) allowable stress in its various steel sections.

(i) Permissible average shear stress $\tau_{va} = 0.40\ f_y$

(ii) Permissible maximum shear stress $\tau_{vm} = 0.45\ f_y$

(iii) Permissible axial tensile stress $\sigma_{at} = 0.60\ f_y$

(iv) Permissible axial compressive stress $\sigma_{ac} \le 0.60\ f_y$

(v) Permissible bending tensile stress $\sigma_{bt} = 0.66\ f_y$

(vi) Permissible bending compressive stress $\sigma_{bc} \le 0.66f_y$

(vii) Permissible bearing stress $\sigma_p = 0.75\ f_y$

(viii) Permissible combined bearing and bending stress $\sigma_c = 0.90\ f_y$

where f_y = yield stress of steel.

→ Permissible maximum shear stress

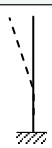
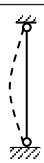
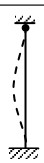
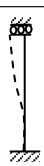
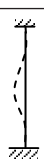
$\tau_{vmax} = 0.45\ f_y$

119. As per IS 800 : 2007, the recommended value of an effective length for compression members of constant dimensions effectively held in position at both ends, but not restrained against rotation, is

(a) 1.00L (b) 1.20L (c) 1.50L (d) 2.00L

119. Ans: (a)

Sol:

Boundary Conditions				Schematic representation	Effective Length (KL)
At one end		At the other end			
Translation	Rotation	Translation	Rotation		
Restrained	Restrained	Free	Free	 (Fixed-Free)	2.0L
Restrained	Free	Free	Restrained	 (Hinged-Rigid roller)	2.0 L
Restrained	Free	Restrained	Free	 (Hinged -Hinged)	1.0L
Restrained	Restrained	Restrained	Free	 (Fixed-Hinged)	0.8L
Restrained	Restrained	Free	Restrained	 (Fixed-Rigid roller)	1.20L
Restrained	Restrained	Restrained	Restrained	 (Fixed -Fixed)	0.65L
L is the unsupported length of the compression member					

120. Which one of the following is applicable in case of analysis of portal bracing?

(a) Portal bracings are provided at one end of the truss girder bridge in the plane of end posts

(b) In addition to the lateral force due to wind, the bracings are also designed to carry a lateral shear equal to $1\frac{1}{4}$ percent of the total compressive force in two end posts

(c) The maximum wind load of loaded span is taken into consideration

(d) Portal bracings are generally provided in more than one plane, located anywhere except in the central transverse plane of end posts

120. Ans: (b)

Sol:

- Portal bracings are provided at each end of truss girder bridge, in the plane of end posts.
- In addition to the lateral force due to wind (in the form of accumulated reaction), it is also designed to carry a lateral shear equal to $1\frac{1}{4}$ percent of total compressive force in the two end posts or in the two top chords of the end panels, whichever is greater.
- Maximum wind load of unloaded span is taken into consideration.
- Portal bracing is generally provided in one plane, located preferably in the central transverse plane of end posts. Some times it is provided in two planes.

121. Consider the following data :

Weight of a dish = 48.6212 g

100 ml of sample is placed in the dish and evaporated. The new weight of the dish and dry solids = 48.6432 g

The dish is placed in a 550 °C furnace, then cooled.

New weight = 48.6300 g

In this case, the total volatile solids are

(a) 132 mg/L (b) 220 mg/L

(c) 88 mg/L. (d) 308 mg/L

121. Ans: (a)

Sol: $w_1 = 48.6212$ g

$v = 100$ m*l*

$w_2 = 48.6432$ g (dried wt)

temp = 550°C

$w_3 = 48.63$ g

Total volatile solids are:

$w_2 \rightarrow$ wt of dish + volatile + non volatile solids

$w_3 \rightarrow$ wt of dish + non volatile solids

$$\therefore \text{volatile solids} = \frac{w_2 - w_3}{v}$$

$$= \frac{48.6432 - 48.63\ \text{g}}{100\ \text{m}l} = 132\ \text{mg/L}$$

122. The radius of the Mohr's circle of stress is

(a) $\sqrt{\left(\frac{\sigma_x + \sigma_y}{2}\right)^2 - \tau^2}$ (b) $\sqrt{\left(\frac{\sigma_x - \sigma_y}{2}\right)^2 + \tau^2}$

(c) $\sqrt{\left(\frac{\sigma_x - \sigma_y}{2}\right)^2 - \tau^2}$ (d) $\sqrt{\left(\frac{\sigma_x + \sigma_y}{2}\right)^2 + \tau^2}$

where σ_x and σ_y are normal stresses, and τ is shear stress.

122. Ans: (b)

Sol: Radius of Mohr circle $= \sqrt{\left(\frac{\sigma_x - \sigma_y}{2}\right)^2 + \tau_{xy}^2}$

123. Which one of the following statements is not correct regarding theories of failure?

(a) The cause of failure depends on the properties of the material.

(b) In case of brittle materials, the maximum principal stress theory should be used.

(c) For ductile materials, the maximum shear stress theory gives good approximation.

(d) The cause of failure is not dependent on the stress system to which it is subjected.

123. Ans: (d)

Sol: The incorrect statement is (d)

The cause of failure depends on stress system.

124. The principal stresses at a point in an elastic material are 2σ tensile and σ tensile. If an elastic limit in simple tension is 200 N/mm^2, according to the maximum principal stress theory, the value of σ at failure will be

(a) 108 N/mm^2 (b) 100 N/mm^2

(c) 90 N/mm^2 (d) 80 N/mm^2

124. Ans: (b)

Sol: $\sigma_1 = 2\sigma$; $\sigma_2 = \sigma$

$f_y = 200$ N/mm^2 (or) MPa

Assume factor of safety , $F_S = 1$

From maximum principal stress theory

$$\sigma_1 \not> \frac{f_y}{F_S}$$

$$\sigma_1 = \frac{f_y}{F_S} \quad \text{[At failure]}$$

$$2(\sigma) = \frac{200}{1} \Rightarrow \sigma = 100 \text{ MPa}$$

125. In case of simple tension or compression, the maximum shear stress is equal to

(a) the applied stress and acts on planes at 45° to it

(b) one-half the applied stress and acts on planes at 45° to it

(c) the applied stress and acts on planes at 60° to it

(d) one-half the applied stress and acts on planes at 60° to it

125. Ans: (b)

Sol: For uniaxial tension or compression system, maximum shear stress is half the major principal stress.

$\left[\tau_{max} = \frac{\sigma}{2}\right]$ acts on 45° planes

126. For a general two-dimensional stress system, the maximum principal stress σ_1 is

(a) $\frac{\sigma_x + \sigma_y}{2} - \sqrt{\left(\frac{\sigma_x + \sigma_y}{2}\right)^2 + \tau_{xy}^2}$

(b) $\frac{\sigma_x + \sigma_y}{2} + \sqrt{\left(\frac{\sigma_x - \sigma_y}{2}\right)^2 - \tau_{xy}^2}$

(c) $\frac{\sigma_x + \sigma_y}{2} - \sqrt{\left(\frac{\sigma_x + \sigma_y}{2}\right)^2 - \tau_{xy}^2}$

(d) $\frac{\sigma_x + \sigma_y}{2} + \sqrt{\left(\frac{\sigma_x - \sigma_y}{2}\right)^2 + \tau_{xy}^2}$

Where σ_x and σ_y are direct stresses on mutually perpendicular planes and τ_{xy} is shear stress on planes.

126. Ans: (d)

127. On a principal plane, the value of shear stress is

(a) half of principal stress

(b) maximum

(c) zero

(d) equal to principal stress

127. Ans: (c)

Sol: On principal plane shear stress is equal to zero.

128. A circular log of timber has diameter d. The ratio of breadth b to depth h (b : h) of the rectangular beam that can be cut from a circular log for strongest section in bending is

(a) 1 : 1 (b) 1: $\sqrt{2}$ (c) 1: $\sqrt{3}$ (d) 1 : 2

128. Ans: (b)

Sol: The dimension of strongest rectangle cut from a circular log of wood $\left[\frac{b}{d}=\frac{1}{\sqrt{2}}\right]$ (Remember this as a standard case).

129. The torsional stiffness k is given by the relation

(a) $k=\frac{GJ}{l}$ (b) $k=\frac{Gl}{J}$

(c) $k=\frac{lJ}{G}$ (d) $k=\frac{GJ}{l^2}$

where G is rigidity modulus, J is polar moment of inertia and l is length.

129. Ans: (a)

Sol: Torsional stiffness, $K_T=\frac{T}{\theta}=\frac{GJ}{l}$

130. A cast iron main tube 800 mm in diameter carries water at pressure head of 100 m. If the maximum permissible tensile stress is 20 MN/m^2 and the weight of water is 10 kN/m^3, the required thickness of the metal will be

(a) 5 mm (b) 10 mm

(c) 15 mm (d) 20 mm

130. Ans: (d)

Sol: Water pressure, $P=\gamma H=(10\ kN/m^3)(100\ m)$

$=1000\ kN/m^2$ (or) kPa

$=1\ MPa$

$D=800$ mm; $\sigma_h=20\ MN/m^2$ (or) MPa

$\therefore \sigma_h=\frac{PD}{2t}$

$20=\frac{(1)(800)}{2t}\rightarrow t=20$ mm

131. A cylindrical air drum is 2.25 m in diameter with plates 1.2 cm thick. The efficiencies of the longitudinal and circumferential joints are 75% and 40% respectively. If the tensile stress in the plate is limited to 120 MN/m^2, the safe maximum air pressure will be

(a) 0.84 MN/m^2 (b) 0.96 MN/m^2

(c) 1.02 MN/m^2 (d) 1.56 MN/m^2

131. Ans: (b)

Sol: $D=2.25\ m=2250$ mm

$t=1.2\ cm=12$ mm

$\eta_L=75\%=0.75$

$\eta_H=40\%=0.4$

$\sigma_h=120\ MN/m^2$ (or) MPa

$\sigma_h=\frac{PD}{2t\eta_L}$ & $\sigma_l=\frac{PD}{4t\eta_H}$

$120=\frac{(P)(2250)}{(2)(12)(0.75)}$

$P=0.96\ MN/m^2$ (or) MPa

132. The maximum shear stress τ_{max} for a beam of circular section is

(a) $\frac{5V}{3A}$ (b) $\frac{3V}{4A}$ (c) $\frac{3V}{5A}$ (d) $\frac{4V}{3A}$

where A is cross-sectional area and V is shear force.

132. Ans: (d)

133. Consider a rectangular hollow section having overall width B and overall depth D, and let the width and depth of the symmetrically placed hole be b and d respectively. Then the section modulus (Z) is

(a) $\frac{(BD^3-bd^3)}{6d}$ (b) $\frac{(BD^3-bd^3)}{12D}$

(c) $\frac{(BD^3-bd^3)}{12d}$ (d) $\frac{(BD^3-bd^3)}{6D}$

133. Ans: (d)

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AIR 10

AKSHAY VIDHATE

TOTAL 36 SELECTIONS IN TOP 10 | **CE: 09 | ME: 10 | EE: 08 | E&T: 09**

134. A long rectangular wall is 2.5 m wide. The maximum wind pressure on the face of wall is 1.1 kN/m^2 and the specific weight of masonry is 22 kN/m^3. If the length of the wall is 1 m, the maximum height of the wall so that there is no tension in the base of the wall will be nearly

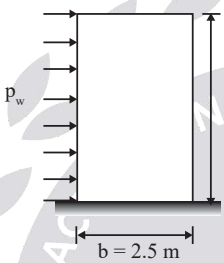
(a) 52 m (b) 42 m (c) 32 m (d) 22 m

134. Ans: (b)

Sol: **Given:** L = 1 m b = 2.5 m

$p_w = 1.1\ kN/m^2$

$\gamma_m = 22\ kN/m^3$



Axial stress due to self-weight = $\sigma_{axial} = \gamma h$

$= 22 \times h = 22\ h\ kN/m^2$

B.M due to wind pressure = $M_{max} = \frac{p_w.h^2}{2}$

and bending stress = $\sigma_{bending} = \frac{M}{Z_{NA}} = \frac{6M}{b^2L}$

$= \frac{6 \times \left(\frac{p_w.h^2}{2}\right)}{2.5^2 \times 1} = \frac{6 \times 1.1 \times h^2}{2 \times 2.5 \times 2.5}$

Condition for no tension: $\sigma_{bending} = \sigma_{axial}$

$\frac{6 \times 1.1 \times h^2}{2 \times 2.5 \times 2.5} = 22\ h$

$h = 41.667\ m \cong 42\ m$

135. A fixed beam of span l is subjected to a central concentrated load W. The bending moment at the supports will be

(a) $\frac{Wl}{4}$ (b) $\frac{Wl}{8}$ (c) $\frac{Wl^2}{4}$ (d) $\frac{Wl^2}{8}$

135. Ans: (b)

136. 'Rind gall' of sapwood is characterized by

(a) longitudinal cracks normal to annular rings

(b) swelling caused by growth of layers over wounds after the branch has been cut off in an irregular manner

(c) wood with twisted fibers

(d) discoloration

136. Ans: (b)

Sol: Rind galls are abnormal growths that occur on trees, particularly in timber. They form when the bark of a tree thickens excessively over an injured area, creating a swollen, enlarged wood cover. This happens due to improper cutting of branches or other damage to the tree, leading to an overgrowth of bark. Essentially, it's the tree's way of healing itself, but it results in a defect in the timber.

137. Which one of the following is correct with respect to incident in the context of construction safety?

(a) Dangerous or unpleasant situation from which someone just manages to escape

(b) Disruption in the normal or smooth flow of work that involves an injury, property loss, damaged equipment, work stoppage, etc.

(c) Unsafe physical condition that could lead to an injury, accident, or loss

(d) Potential for loss resulting from a given action, activity or inaction

137. Ans: (b)

Sol: Incident in the context of construction Safety:

- Unexpected event that occurs in a construction site causing an injury, illness, death and property damage. The common types of incidents are falls, struck by machinery/vehicles, electrocution, trapped between objects, fires and explosion etc.

138. For a concrete mix design, an estimation of water content corresponds to
(a) oven-dried aggregates
(b) saturated surface dry aggregates
(c) air-dried aggregates
(d) wet aggregates

138. Ans: (b)

Sol: In concrete mix design as per IS 10262:2019, for the determination of water content weight of coarse aggregates based on saturated surface dry condition is considered.

139. For maximum strength, the desired workability of fresh concrete can be attained by which one of the following measures?
(a) The proportion of coarse aggregate may be increased
(b) The proportion of fine aggregate may be reduced
(c) The process of mixing concrete can be repeated second time by the use of vibrators
(d) The quantity of cement may be increased while quantity of water may be reduced

139. Ans: (a)

Sol: As the coarse aggregate content in concrete increases, the strength of the concrete improves due to enhanced interlocking between particles. Additionally, the increase in coarse aggregate reduces the fine aggregate content, which lowers the specific surface area of the aggregates. This reduction minimizes the absorption of cement paste by the aggregate surface, ensuring that more cement paste remains available, ultimately enhancing the workability of the concrete.

140. Plywoods are classified as Boiling Water Resistant (BWR) grade and Moisture Resistant (MR) grade depending on
(a) appearance of surface
(b) thickness of plywood
(c) density of plywood
(d) bond strength developed by adhesive used for bonding the veneers.

140. Ans: (d)

Sol: The classification of plywood as BWR (Boiling Water Resistant) or MR (Moisture Resistant) is primarily based on its water resistance capacity and the type of adhesive used in its manufacturing. MR Plywood is moisture-resistant but not waterproof. It is bonded using urea-formaldehyde resin, making it suitable for indoor furniture and areas with moderate humidity. BWR Plywood is highly water-resistant and is bonded using phenol-formaldehyde resin, which provides better durability and resistance to moisture. It is ideal for kitchens, bathrooms, and outdoor furniture.

141. High percentage presence of free silica in lime exhibits
(a) good cementing and quick setting properties
(b) high strength and cementing properties
(c) good cementing and hydraulic properties
(d) poor cementing and hydraulic properties

141. Ans: (d)

Sol: A high percentage of free silica in lime negatively impacts its properties. It leads to poor cementing and hydraulic characteristics, making the lime less effective in construction applications.

142. Which one of the following is the correct sequence in increasing order for the chemical composition of Portland cement?
(a) Fe_2O_3, Al_2O_3, SiO_2, CaO
(b) Al_2O_3, Fe_2O_3, SiO_2, CaO
(c) Fe_2O_3, Al_2O_3, CaO, SiO_2
(d) Al_2O_3, SiO_2, Fe_2O_3, CaO

142. Ans: (a)

Sol: Proportion of different chemical compounds present in the raw materials used in the manufacture of cement are as follows:

Lime	-	60 to 67%
Silica	-	17 to 25%
Alumina	-	3 to 8%
Iron Oxide	-	0.5 to 6%

143. As per the straight line method, what is the annual depreciation value of an equipment that has delivered price of ₹1,00,000 and has a residual value of 10% of delivered price? Assume the ownership period as 5 years.
(a) ₹ 18,000/year (b) ₹ 2,000/year
(c) ₹ 20,000/year (d) ₹ 9,000/year

143. Ans: (a)

Sol: Delivered price (P) = 1,00,000/-
Residual value (SV) = 10% of 1,00,000 = 10,000/-
Ownership period (n) = 5 years
Annual depreciation using straight line method

$$(D) = \frac{P - SV}{n}$$

$$= \frac{1,00,000 - 10,000}{5} = 18,000$$

144. Sugar added to cement mortar
(a) accelerates setting time and destroys the early strength
(b) delays setting time and destroys the early strength
(c) accelerates setting time and increases the early strength
(d) delays setting time and increases the early strength

144. Ans: (b)

Sol: Sugar acts as a retarder in mortar, meaning it slows down the setting process of cement. This extended timeframe improves workability, making it easier to shape and finish the mortar. However, excessive sugar can weaken the structure, reducing its compressive strength over time.

145. Which one of the following is not the correct characteristic of an ideal mortar?
(a) Develops good adhesion with building unit such as bricks and stones
(b) Withstands the stresses developed
(c) Offers less resistance to water penetration
(d) Durability

145. Ans: (c)

Sol: A good quality mortar should offer resistance against penetration of moisture i.e., it should have low permeability.

146. Surkhi is added to lime mortar for furnishing
(a) hydraulic properties (b) adhesive properties
(c) solubility properties (d) cohesive properties

146. Ans: (a)

Sol: Surkhi is added to lime mortar primarily to impart hydraulicity and increase strength. It is a powdered form of burnt bricks or clay, used as a substitute for sand in mortar and concrete. Surkhi improves the durability of lime mortar and helps prevent shrinkage.

147. A power plant has a stack with a diameter of 2 m and emits gases with a stack exit velocity of 15 m/s and a heat emission rate of 4900 kJ/s. The wind speed is 5 m/s, Stability is neutral, If the stack has a geometric height of 40 m, what is the effective stack height, nearly?

(a) 40 m (b) 60 m
(c) 80 m (d) 100 m

147. Ans: (d)

Sol: **Effective stack height**

For super adiabatic continuous

$$\Delta h = 3.47\frac{V_s d}{u} + 5.15\frac{Q_h^{0.5}}{u}$$

For neutral stability

$$\Delta h = 0.35\frac{V_s d}{u} + 2.64\frac{Q_h^{0.5}}{u}$$

For sub adiabatic conditions

$$\Delta h = -1.04\frac{V_s d}{u} + 2.24\frac{Q_h^{0.5}}{u}$$

Where

V_s = stack gas exit speed

d = slack diameter (in m), and

Q_n = heat emission rate from the stack (in kJ/S)

In the questions it is given stability is neutral.

$$\therefore \Delta h = 0.35\frac{V_s d}{u} + 2.64\frac{Q_h^{0.5}}{u}$$

$$= 0.35 \times \frac{15 \times 2}{5} + 2.64 \times \frac{\sqrt{4900}}{5}$$

$$= (0.35 \times 6) + 2.64 \times \frac{70}{5}$$

$$= 2.1 + 36.96$$

$$= 39.06 \text{ m}$$

$\therefore$ Effective slack height $H = h_g + \Delta h$

$= 40 + 39.06 = \approx 80$ m

148. A steel punch can be stressed to maximum compressive stress of 800 MN/m^2. If the ultimate shear strength is 300 MN/m^2, the least diameter of the hole that can be punched through a steel plate of 14 mm thickness will be

(a) 41 mm (b) 31 mm
(c) 21 mm (d) 11 mm

148. Ans: (c)

Sol: Punching force = shear resistance of plate

$$\sigma\left[\frac{\pi}{4}d^2\right] = \tau[\pi.d.t]$$

$$800\left[\frac{\pi}{4}d^2\right] = 300[\pi.d.14]$$

Least diameter, d = 21 mm

149. A bar of 2500 mm^2 cross-sectional area is subjected to an axial load of 150 kN. The extension over a gauge length of 100 mm is 0.05 mm. If the decrease in each side is 0.00625 mm, the value of Poisson's ratio is

(a) $\frac{1}{5}$ (b) $\frac{1}{4}$
(c) $\frac{1}{3}$ (d) $\frac{1}{2}$

149. Ans: (b)

Sol: $A = 2500 = \frac{\pi}{4} d^2$

diameter, d = 56 mm

P = 150 kN (extra data)

$$\frac{\delta l}{l} = \frac{0.05}{100}$$

$$\frac{\delta D}{D} = \frac{0.00625}{56}$$

$$\mu = \frac{\varepsilon_{lat}}{\varepsilon_{lin}} = \frac{\left(\frac{\delta D}{D}\right)}{\left(\frac{\delta l}{l}\right)} = \frac{1}{4}$$

150. The resilience in simple tension or compression is

(a) $\frac{\sigma^2}{2E}$ (b) $\frac{\sigma^2}{2A}$

(c) $\frac{\sigma^2}{2AE}$ (d) $\frac{2\sigma^2}{AE}$

where σ is tensile or compressive stress, A is area of cross-section and E is modulus of elasticity.

150. Ans: (a)

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