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ESE-2022
(PRELIMINARY EXAMINATION)

QUESTIONS WITH DETAILED SOLUTIONS

CIVIL ENGINEERING

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ESE - 2022

CIVIL ENGINEERING

Questions with Detailed Solutions

SET - A
20/02/22

SUBJECTWISE WEIGHTAGE

S. No.	NAME OF THE SUBJECT	Number of Questions
01	Building Materials	13
02	Solid Mechanics	16
03	Structural Analysis	9
04	Design of Steel structures	14
05	Design of Concrete & Masonry Structures	14
06	Construction Practice, Planning & Management	11
07	Fluid Mechanics & Hydraulic Machines	13
08	Engineering Hydrology	2
09	Irrigation Engineering	8
10	Environmental Engineering	13
11	Geotechnical Engineering	14
12	Surveying	12
13	Geology	1
14	Transportation Engineering (Highways, Railways, Airports, Harbours & Tunnels)	10
Total No. of Questions		**150**

01. Which one of the following statements is NOT correct regarding the relationships between bending moment, shear force and applied load?

(a) The rate of change of shear force along a beam is equal to the distributed load.

(b) The rate of change of bending moment along a beam is equal to the shear force.

(c) The rate of change of bending moment along a beam is equal to the distributed load.

(d) The shear force and bending moment at free end is always zero

01. Ans: (c)

Sol: Statement (a) : $\frac{dF}{dx} = \ominus w \rightarrow$ CORRECT

Statement (b) : $\frac{dM}{dx} = F \rightarrow$ CORRECT

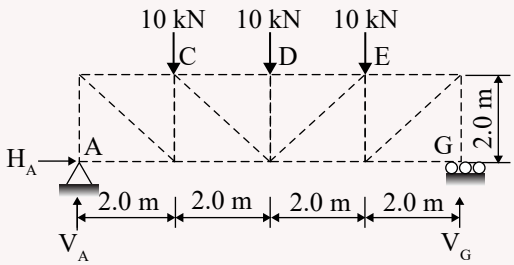
Statement (c) : $\frac{dM}{dx} = \ominus w \rightarrow$ INCORRECT

Statement (d): Under distributed load

$F = 0$ and $M = 0$

at Free end $\rightarrow$ CORRECT

02. What is the support reaction V_G from the following figure?



(a) 15 kN (upward)

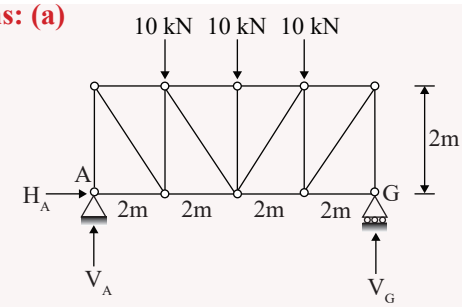
(b) 20 kN (upward)

(c) 15 kN (downward)

(d) 20 kN (downward)

02. Ans: (a)

Sol:



$\Sigma M_A = 0$,

$8V_G = (10\times6)+(10\times4)+(10\times2)$

$V_G = 15$ kN upward

03. Consider the following assumptions for pure bending theory :

1. The material is heterogeneous and isotropic.
2. The stress is purely longitudinal and local effects near concentrated loads will be neglected.
3. The radius of curvature is large compared with the dimensions of the cross-section.

Which of the above statements are correct?

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

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

03. Ans: (b)

Sol: Statement (1) : Incorrect

Statement (2): Correct

In SOM analysis, st. venants principle is valid.

Statement (3): Correct

R >>> c/s dimensions in pure bending

04. For a fixed-connected collar type of support connection in coplanar structures, the number of unknown(s) is/are

(a) three and the reactions are two forces and a moment component.

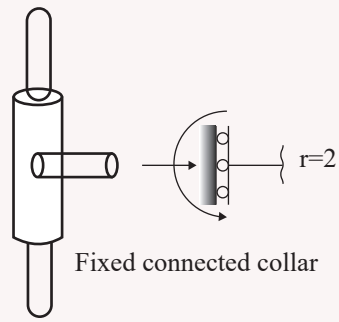
(b) one and the reaction is a moment components.

(c) two and the reactions are two forces (one horizontal and one vertical)

(d) two and the reactions are a force and a moment.

04. Ans: (d)

Sol:



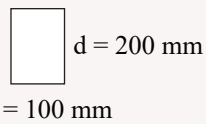
05. For a rectangular beam of 4 m long with 100 mm wide and 200 mm deep, it carries a shear force of 100 kN. What is the maximum shear stress (τ_{max}) due to the bending of rectangular section?

(a) 2.5 N/mm^2 (b) 5 N/mm^2

(c)7.5 N/mm^2 (d) 10 N/mm^2

05. Ans: (c)

Sol:



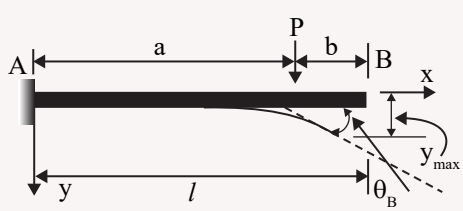
F= 100 10^3 N $\quad l = 4$ m

For Rectangular c/s

$$\tau_{max} = \frac{3}{2}(\tau_{avg})$$

$$\tau_{max} = \frac{3}{2}\left(\frac{F}{bd}\right) = \frac{3}{2} \times \frac{100 \times 10^3}{100 \times 200} = 7.5 \text{ N/mm}^2$$

06. What is the maximum deflection (y_{max}), for a cantilever beam of span 'l' subjected to a point load acting at a distance 'a' from the fixed end as shown in figure? (Take Young's modulus as E and moment of inertia of beam section as I)

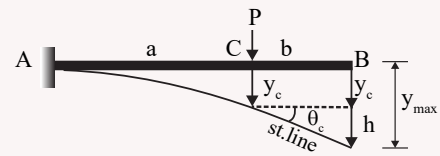


(a) $y_{max} = \frac{Pa^2}{6EI}(3l - a)$ (b) $y_{max} = \frac{Pa^2}{3EI}(3l - a)$

(c) $y_{max} = \frac{3Pa^2}{2EI}(3l - a)$ (d) $y_{max} = \frac{Pa^2}{2EI}(3l - a)$

06. Ans: (a)

Sol:



$l = a + b$

$y_{max} = y_c + h$

$y_{max} = y_c + \theta_c . b$

$$= \frac{Pa^3}{3EI} + \frac{Pa^2}{2EI}.b$$

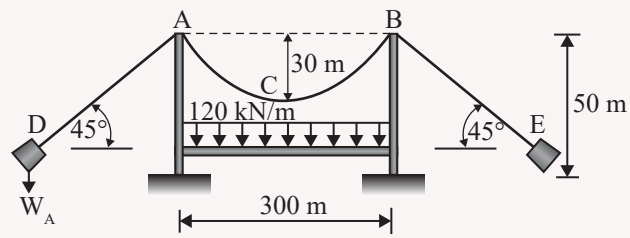
$$= \frac{Pa^3}{3EI} + \frac{Pa^2}{2EI}(l - a)$$

$$= \frac{Pa^2}{EI}\left[\frac{a}{3} + \frac{(l - a)}{2}\right]$$

$$= \frac{Pa^2}{EI}\left\{\frac{2a + 3l - 3a}{6}\right\}$$

$$= \frac{Pa^2}{6EI}(3l - a)$$

07. What is the maximum tension (approximately) in the cable as shown in figure, if it carries a uniform horizontally distributed load of intensity 120 kN/m?



(a) 48.5 kN (b) 48.5 MN

(c) 485 kN (d) 4850 N

07. Ans: (b)

Sol:

$$\text{Max. tension} = \sqrt{\left(\frac{WL}{2}\right)^2 + \left(\frac{WL}{8h}\right)^2}$$

$$= \sqrt{\left(\frac{120 \times 800}{2}\right)^2 + \left(\frac{120 \times 300^2}{8 \times 30}\right)^2}$$

Max. tension = 48.46 MN

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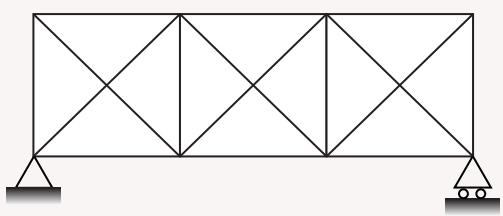
08. Consider the following statements:
1. For a given load, the deflection of an indeterminate structure is smaller than that of determinate structure.
2. For a given load, the maximum stress of an indeterminate structure is higher than that of determinate structure.
3. For a given load, the maximum stress of an indeterminate structure is smaller than that of determinate structure.

Which of the above statements is/are correct?

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

08. Ans: (c)

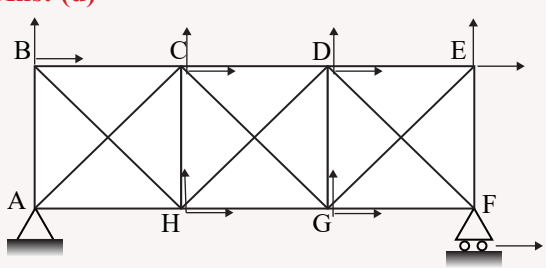
09. What is the degree of kinematic indeterminacy of the truss as shown in figure?



(a) 10 (b) 11 (c) 12 (d) 13

09. Ans: (d)

Sol:



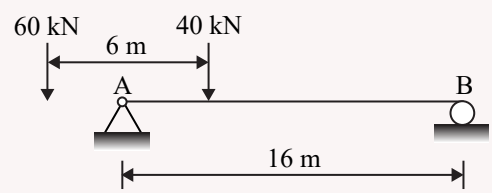
There are 2 degree of freedom per joint (B, C, D, E, H, G) along with horizontal displacement at support F.

The total degree of freedom (D_k) = 13

10. Which one of the following statements is NOT correct?
(a) The influence lines are constructed for establishing the maximum design forces at critical sections produced by moving.
(b) As a moving load passes over a structure, the internal forces at each point in the structure do not vary.
(c) To ensure the safety of a structure, the capacity of section should be greater than or equal to all the combination of loads.
(d) The maximum deflection occurs at the centre of a simply supported beam, when a concentrated load applied at the mid-span.

10. Ans: (b)

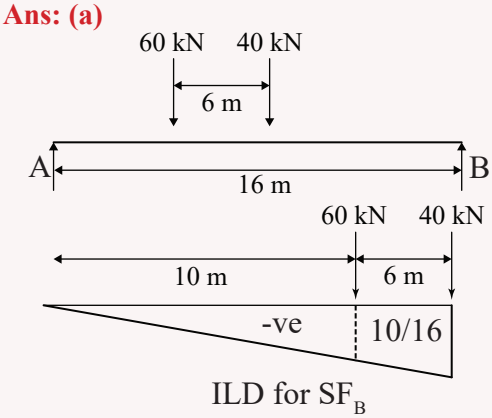
11. Two loads of 40 kN and 60 kN are moving towards support B as shown in figure. What is the maximum negative shear force at B?



(a) –77.5 kN (b) –7.75 kN
(c) –37.5 kN (d) –3.75 kN

11. Ans: (a)

Sol:



ILD for SF_B

Max − ve SF_{eB} = [load × coordinate of ILD]
= –40×1–60×0.625
Max − Ve Shear force @ B =− 77.5 kN

12. Consider the following statements related to the uses of computer programs in the structural analysis.
1. To analyze a truss with rigid joints would be a lengthy computation by the classical methods of analysis.
2. The rigid joints (in truss analysis) are assumed to be pinned joints by the designers to simplify the problem.
3. The computer programs enable to consider the real situation (rigid joints) and also give the accurate results in a quick time.

Which of the above statements are correct?
(a) 1 and 2 only (b) 2 and 3 only
(c) 1 and 3 only (d) 1, 2 and 3

12. Ans: (d)

Sol: It is universal practice to assume the members to be pin connected i.e. with single bolt/pin at each member end.
However, this is never the case for a roof truss. The members are rigidly bolted (more than one bolt) or welded to gusset plates or to each other at the joints.

13. If the load is transmitted by bolts or rivets through some but not all the cross-sectional elements of the member, the effective area A_e is computed by using net area A_n and the reduction coefficient U as
(a) $A_e = U A_n$ (b) $A_e = A_n/U$
(c) $A_e = 0.87 UA_n$ (d) $A_e = 0.66 U A_n$

13. Ans: (a)

Sol: $A_e = UA_n$
As per IS 800:200
$A_{ue} = \alpha A_u$
$\alpha \rightarrow$ Shear lag reduction factor
Here 'U' is analogous to α

14. If the net end moments of a compression member are zero then such member is called
(a) beam column (b) axially loaded column
(c) a truss (d) a girder

14. Ans: (b)

15. Consider the following factors that affect the behavior of a column under a compression load:
1. The stress-strain properties remain constant throughout the section.
2. The column may not be perfectly straight as the load is applied to it.
3. End condition may vary from case to case.

Which of the above statements are being ignored in the Euler approach?
(a) 1 and 2 only (b) 1 and 3 only
(c) 2 and 3 only (d) 1, 2 and 3

15. Ans: (a)

Sol: Statement (1): Ignored in Euler approach.
Due to variation in bending moment stress strain properties change from section to section but it is ignored.
Statement (2): Column must be Initially straight in Euler approach.
Statement (3): End conditions may vary from case to case → consider in Euler approach.

16. What is the effective length of a steel prismatic compression member for which, the translation and rotation are restricted at both the ends?
(a) 0.80 L (b) 1.00 L
(c) 1.20 L (d) 0.65 L

16. Ans: (d)

Sol: Translation and rotation are restricted at both the ends
Both ends fixed $L_{eff} = 0.5L$ (Theoretical)
$L_{eff} = 0.65L$ (Practical)

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17. By considering the net area as A_n, ultimate stress as f_u and the partial safety factor as γ_{ml}, the IS code formula for preliminary design of a tension member for design strength due to rupture (T_{dn}) of the critical section is

(a) $T_{dn} = \frac{\alpha A_n f_u}{2\gamma_{ml}}$ (b) $T_{dn} = \frac{A_n f_u}{\alpha\gamma_{ml}}$

(c) $T_{dn} = \frac{\gamma_{ml} A_n f_u}{\alpha}$ (d) $T_{dn} = \frac{\alpha A_n f_u}{\gamma_{ml}}$

17. Ans: (d)

Sol: For preliminary design purpose, IS recommends the following expression

$$T_{dn} = \frac{\alpha A_n f_u}{\gamma_{ml}}$$

where

$\alpha = 0.6$, when no. of bolts ≤ 2

$\alpha = 0.7$, when no. of bolts $= 3$

$\alpha = 0.8$, when no. of bolts ≥ 4

$\alpha = 0.8$, For welds

18. Consider the following statements regarding the classification of beams:

1. Floor beams are often referred to as girders.
2. Joist is a beam supporting floor construction but not a major beam.
3. Rafter is a roof beam, usually supported by roof truss.

Which of the above statements are correct?

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

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

18. Ans: (a)

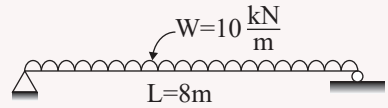
19. A simply supported steel beam of 8 m long and subjected to a uniformly distributed load of 10 kN/m. What is the maximum bending stress (f_b) of the member at a distance of 50 mm from the neutral axis? (Take $I = 10 \times 10^5$ mm^4)

(a) 400 N/mm^2 (b) 4000 N/mm^2

(c) 800 N/mm^2 (d) 8000 N/mm^2

19. Ans: (b)

Sol:



$I_{N.A} = 10 \times 15^5$ mm^4 $\quad y = 50$ mm

$$M_{max} = \frac{WL^2}{8} = \frac{\frac{10 \times 10^3}{10^3}\text{N/mm}^2 \times (8000)^2\text{mm}^2}{8}$$

$$\therefore (\sigma_{bending})_{@y=50mm} = \frac{M}{I_{N.A}}.y$$

$$= \frac{\left(\frac{10 \times 10^3}{10^3}\right) \times 8000^2}{8} \times 50 = 4000 \text{ N/mm}^2$$

20. Arrange the following steps involved in the design of beam columns in a correct sequence:

1. Determine the factored loads and moments acting on the beam column using a first-order elastic analysis.
2. Choose an initial section and calculate the necessary section properties.
3. Classify the cross section as per the IS code.
4. Find out the bending strength of the cross section about the major and minor axis of the member.

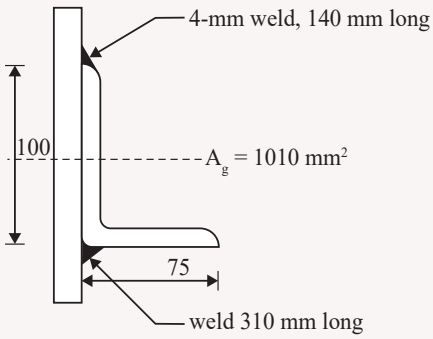
Select the correct answer using the code given below.

(a) 2, 3, 1, 4 (b) 3, 1, 2, 4

(c) 1, 2, 3, 4 (d) 4, 3, 2, 1

20. Ans: (c)

21. What is the approximate value of the tensile strength governed by yielding of the cross section of a roof truss diagonal 100 × 75 × 6 mm (f_y = 250 MPa) connected to the gusset plate by 4 mm welds as shown in figure? (Take partial safety factor as 1.10)



(a) 230 kN (b) 23 kN
(c) 320 kN (d) 32 kN

21. Ans: (a)

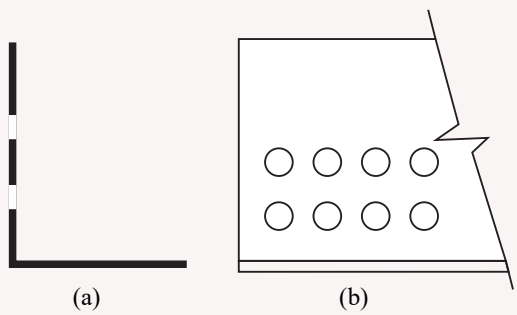
Sol: As per gross area yielding

$$T_{dy} = \frac{f_y A_g}{\gamma_{ml}}$$

$$= \frac{250 \times 1010}{1.1} = 229.545 \text{ kN}$$

$$\simeq 230 \text{ kN}$$

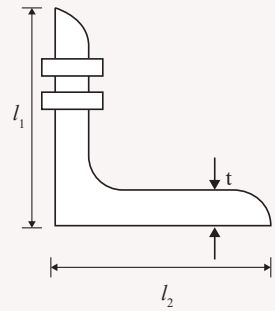
22. A tension member is made up of a single angle 200 mm × 150 mm × 15 mm with a gross area of 30 cm². Two rows of 18 mm diameter bolts (take hole diameter = 20 mm) are used (as shown in figure (a) and (b)). What is the net area?



(a) 2460 mm² (b) 2500 mm²
(c) 2400 mm² (d) 2560 mm²

22. Ans: (c)

Sol:



Net area = Gross area – Bolt area

$A_{nc} = (30 \times 10 \times 10) - (2 \times 20 \times 15)$

$= 3000 - 600 = 2400 \text{ mm}^2$

23. In a plate girder subjected to a bending moment of 200 kNm, the width and thickness of flange are 200 mm and 10 mm respectively. What is the economical depth of the girder by assuming the moment is resisted by the flange only? (Take f_y = 250 MPa)

(a) 800 mm (b) 400 mm
(c) 500 mm (d) 700 mm

23. Ans: (b)

Sol: $$d = \frac{M_Z}{f_y \times t_f \times b_f} = \frac{200 \times 1000 \times 1000}{250 \times 10 \times 200} = 400 \text{ mm}$$

24. Which one of the following statements is NOT correct regarding gross section yielding?

(a) Generally, a tension member without bolt holes can resist loads up to the ultimate load without failure

(b) A tension member when subjected to an ultimate loads will deform considerably in the longitudinal direction.

(c) A structure becomes more serviceable under the large deformation.

(d) The IS code limits design strength by substituting a partial safety factor of 1.10 for failure in tension.

24. Ans: (c)

Directions for the following five (05) items:

Read the following information and answer the five items that follow.

A singly reinforced concrete beam with an effective span of 4 m has a rectangular cross section with a width of 300 mm and an overall depth of 550 mm. The beam is reinforced with steel of Fe-415 grade of area 250 mm^2 at an effective depth of 500 mm. The self-weight with dead load of the beam is 4 kN/m. Consider M-15 grade concrete and $\sigma_{cbc} = 5$ MPa; $\sigma_{st} = 230$ MPa.

25. What is the bending moment due to dead load?
(a) 8000 Nm (b) 80 kNm
(c) 32 kNm (d) 3200 Nm

25. Ans: (a)

Sol: Bending moment due to dead load

$$m_D = \frac{w_D L^2}{8} = \frac{4 \times 4^2}{8} = 8 \text{ kNm} = 8000 \text{ Nm}$$

26. What is the modular ratio?
(a) 28/3 (b) 40/3
(c) 56/3 (d) 86/3

26. Ans: (c)

Sol: Modular ratio

$$m = \frac{280}{3\sigma_{cbc}} = \frac{280}{3 \times 5} = \frac{56}{3}$$

27. What is the depth of critical neutral axis?
(a) 134.33 mm (b) 124.33 mm
(c) 154.33 mm (d) 144.33 mm

27. Ans: (d)

Sol: Effective depth d = 500 mm

Critical depth of neutral axis

$$x_c = \left[\frac{m\sigma_{cbc}}{m\sigma_{cbc} + \sigma_{st}}\right] d$$

$$= \left[\frac{\frac{56}{3} \times 5}{\frac{56}{3} \times 5 + 230}\right] \times 500 = 144.33 \text{ mm}$$

28. What is the moment of resistance of the section if the actual depth of neutral axis is 100 mm?
(a) 36.83 kNm (b) 26.83 kNm
(c) 16.83 kNm (d) 46.83 kNm

28. Ans: (b)

Sol: Given $x_a = 100$ mm

$x_a < x_c$ $\therefore$ URS ($x_c = 144.33$ mm)

Moment of resistance

$$M.R = \sigma_{st} A_{st}\left[d - \frac{x_a}{3}\right]$$

$$= 230 \times 250\left[500 - \frac{100}{3}\right] = 26.83 \text{ kNm}$$

29. What is the permissible live load on the beam?
(a) 13.43 kN/m (b) 9.43 kN/m
(c) 8.43 kN/m (d) 6.43 kN/m

29. Ans: (b)

Sol: Live load on the beam

Maximum bending moment = MR

$$\frac{wL^2}{8} = 26.83$$

$$\frac{w \times 4^2}{8} = 26.83$$

$w = 13.42$

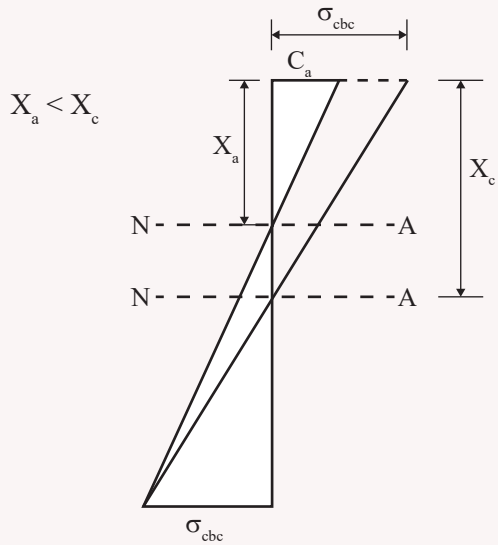
$w = w_L + 4 = 13.42$ ($w_D = 4$ kN/m)

$w_L = 9.42$ kN/m

30. A section is said to be under-reinforced when
(a) The depth of actual neutral axis is greater than the depth of critical neutral axis.
(b) The depth of actual neutral axis is less than the depth of critical neutral axis.
(c) The depth of actual neutral axis is equal to the depth of critical neutral axis.
(d) It is not related to the depth of neutral axis.

30. Ans: (b)

Sol: In an under reinforced section the depth of neutral axis will be less than the critical depth of N.A



31. Consider the following statements regarding the slabs:
    1. When the longer span to shorter span ratio is greater than or equal to two, it is a two-way slab.
    2. In one-way slab, the load transfer is chiefly by bending in the shorter direction.
    3. In two-way slabs, the load transferred by bending in both orthogonal directions.

    Which of the above statements is/are correct?
    (a) 1 and 2 only (b) 3 only
    (c) 2 and 3 only (d) 1 and 3 only

31. Ans: (c)

Sol: **1 False :** If Longer span to shorter span ratio > 2 then it is one way slab.

2. True: In one way slab bending is primary in shorter span direction.

3. True : In two way slab the load transferred by bending in both orthogonal directions.

32. Which one of the following statements is NOT correct in reinforced concrete design?
    (a) In the cracked section, concrete below the neutral axis is neglected in calculations.
    (b) When section is subjected to external loading, resisting moment is developed due to compression in concrete and tension in steel.
    (c) In the cracked section, the steel area below the neutral axis is converted into equivalent concrete area.
    (d) The neutral axis depth does not depend on the modular ratio.

32. Ans: (d)

Sol: Actual depth of Neutral axis

$$\frac{bx_a^2}{2} = mA_{st}(d - x_a)$$

The neutral depth depends on modular ratio.

33. A concrete beam is post-tensioned by a cable carrying an initial stress of 1000 N/mm^2. The slip at the jacking end was observed to be 5 mm. The modulus of elasticity of steel is 210 kN/mm^2. What is the percentage loss of stress due to anchorage slip if the length of the beam is 30 m?
    (a) 3.5% (b) 35% (c) 0.35% (d) 30.5%

33. Ans: (a)

Sol: Loss of prestress due to anchorage slip

$$\Delta\sigma = \frac{\Delta}{L}E_s$$

$$= \frac{5}{30000} \times 210 \times 10^3 = 35 \text{ N/mm}^2$$

$$\% \text{ Loss} = \frac{\Delta\sigma}{\sigma_o} \times 100 = \frac{35}{1000} \times 100 = 3.5\%$$

34. The Indian Standard (IS) code used for design of prestressed concrete is
    (a) IS 4326 : 2013 (b) IS 3920 : 2012
    (c) IS 6512 : 2013 (d) IS 1343 : 2012

34. Ans: (d)

Sol: Code of practice for prestressed concrete IS:1343-2012

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35. Which one of the following statements is NOT correct related to the earthquake resistant design?
(a) Overall depth of a beam should not be greater than one-fourth of the clear span.
(b) The percentage tensile reinforcement should not exceed 2.5.
(c) The reinforcement resisting positive moments at a joint face must be less that half the negative moment reinforcement.
(d) The width to depth ratio should be more than 0.30 to avoid lateral instability

35. Ans: (c)

Sol: The positive moment resistance at the face of joint should not be less than one half of the negative moment resistance provided at the face of joint.

36. Consider the following statements related to isolation concepts in earthquake resistant design:
1. Development of shock-isolation concepts are generally applied to earthquake resistant structures.
2. The shock-isolation concept is a radical departure from current seismic design practice.
3. The successful implementation of shock-isolation concept will ensure the simplification in the design of tall reinforced concrete structures.

Which of the above statements are correct?
(a) 1 and 2 only (b) 2 and 3 only
(c) 1 and 3 only (d) 1, 2 and 3

36. Ans: (d)

37. Dozer primarily is
(a) a pushing unit (b) a lifting unit
(c) a digging unit (d) a pulling unit

37. Ans: (a)

Sol: Dozer is a heavy earth moving equipment used to push the earth loose soils.

38. The process of breaking a major project into its major and sub systems and discrete activities which can be identified easily is called.
(a) Line of balance technique
(b) Work break system
(c) Milestone chart technique
(d) PERT technique

38. Ans: (b)

Sol: Line of balance: Repetitive work elements
Work breakdown structure (WBS) $\Rightarrow$ Activities, sub-activities
Milestone chart : Marks Important activities of a project.
PERT technique: Tool used to analyze and represent tasks involved in completing a given project.

39. Which one of the following statements is NOT correct in respect of stages of construction?
(a) Conceptual stage is before study and evaluation.
(b) Construction stage is after tendering stage.
(c) Design stage is after tendering stage.
(d) Study and evaluation stage is before design stage.

39. Ans: (c)

Sol: Design stage $\Rightarrow$ Tendering stage

40. In a construction project, generally 50% of total project cost is attributed to
(a) Equipment cost only
(b) Material cost only
(c) Manpower cost only
(d) Material plus equipment cost

40. Ans: (b)

Sol: In a construction project, generally 50% of total cost is attributed to materials cost only.

41. Consider the following statements regarding the advantages of planning to the contractor:
    1. The program provides a standard, by which actual work can be measured.
    2. The program provides a preconceived plan for the whole job as well as for various stages of the work.

    Which of the above statements is/are correct?
    (a) 1 only (b) 2 only
    (c) Both 1 and 2 (d) Neither 1 nor 2

41. Ans: (b)

42. Arrange the stages of construction of highway projects in correct sequence:
    1. Cleaning site of work or construction.
    2. Construction of drainage work such as culvert etc.
    3. Earth work
    4. Construction of road and its shoulders

    Select the correct answer using the code given below.
    (a) 1, 2, 3, 4 (b) 1, 3, 2, 4
    (c) 2, 1, 4, 3 (d) 3, 4, 1, 2

42. Ans: (a)

Sol: Cleaning the site → Construction of drainage work → Earthwork → Construction of road and its shoulders.

43. Return on Investment method is useful for
    (a) Economic analysis of project
    (b) Ecological analysis of project
    (c) Financial analysis of project
    (d) Commercial analysis of project

43. Ans: (a)

Sol: ROI method is used for Economic analysis of project.

44. To measure the performance of project against established target and identify deviation from the target are part of which one of the following management functions?
    (a) Planning (b) Directing
    (c) Coordinating (d) Controlling

44. Ans: (d)

Sol: Project controlling deals with monitoring the work progress and control the deviations if any.

45. In bar chart, the length of the bar shows
    (a) materials required for large scale project.
    (b) time required to compete that activity.
    (c) interdependencies of project
    (d) critical activities of the project

45. Ans: (b)

Sol: Length of bar = Activity duration

46. Which one of the following is the amount of time by which the start of an activity may be delayed without delaying the start of a following activity?
    (a) Total float
    (b) Interference float
    (c) Independent float
    (d) Free float

46. Ans: (d)

Sol: **Total Float:** Without affecting the project completion time.

Free Float: Without affecting the start of succeeding (or) following activity.

Independent Float: Without affecting the preceding and succeeding activity.

Interference Float: TF - FF = Slack at head event.

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47. Which of the following is/are consumed time and resources?
(a) Event only
(b) Activity (other than dummy) only
(c) Dummy activity only
(d) Both event and activity (other than dummy)

47. Ans: (b)

Sol: Activity consumes time and resources.

48. Construction quality can NOT be directly affected by
(a) whether a clear set of designs and drawings is available
(b) whether a clear, well-laid-out and unambiguous set of specifications is available
(c) whether a clearly defined time duration of project
(d) whether there has been usage of proper materials, workers and equipments during the construction processes

48. Ans: (c)

Sol: Specifications, proper materials, workers and equipment must be required to ensure the construction quality.

49. Marble is an example of
(a) Metamorphic Rock (b) Sedimentary Rock
(c) Igneous Rock (d) Argillaceous Rock

49. Ans: (a)

Sol: Marble is a metamorphic rock. It is formed when Limestone, a sedimentary rock, is subjected to intensive pressure and heat leading to recrystallization of calcite in the limestone. Hence, option (a) is the correct option.

50. Which one of the following is caused by the crushing of fibres running transversely during the growth of the tree?
(a) Shake (b) Knot
(c) Upset (d) Rind gall

50. Ans: (c)

Sol: Upsets are caused by the crushing of fibers running transversely during the growth of the tree due to strong winds and unskilled felling consequently resulting in discontinuity of fibers. Hence, option (c) is the correct option

51. Which one of the following statements is NOT correct for Aluminum ?
(a) It is less ductile than copper
(b) It is harder than tin
(c) It can be soldered
(d) It can welded

51. Ans: (c)

Sol: Copper is more ductile than Aluminium. Aluminium is harder than Tin as its hardness grade on Mohs scale of hardness is 2.5 to 3 while the hardness grade of Tin is 1.5. Aluminium can be riveted and welded, but cannot be soldered.
Hence, option (c) is the correct option.

52. Which one of the following limes is the quick-lime coming out of kilns?
(a) Lump lime (b) Fat lime
(c) Hydraulic lime (d) Hydrated lime

52. Ans: (a)

Sol: Quicklime is also called as Burnt-lime and Lump-lime as it is formed by burning Limestone in kilns and it comes out in the form of white lumps. Hence, option (a) is the correct option

53. Which one of the following is generally recommended for small jobs only?
(a) Volume batching (b) Weigh batching
(c) Machine mixing (d) Non-tilting mixer

53. Ans: (d)

Sol: In Non-Tilting Mixers the drum rotates about its horizontal axis and is not allowed to tilt. For the discharge of concrete a chute is arranged in inclined position which will receives the concrete mix from drum and discharges out. In this case, the drum is opened at two ends and consists of blades insides when materials are poured through one end and mix is collected through another end.

Rapid discharge of concrete is not possible in this case. So, this type of mixers are generally used for small projects only. Hence, option (d) is the correct option

54. Consider the following statements regarding the transit mixer:
1. Their function is mainly to keep the mix in an agitated condition.
2. These mixers in addition to the outer spirals have four inner spirals.
3. A number of special nozzles provided on the lower side of inner mixing spirals, precisely and uniformly spray water on the mix under pressure along the entire length of the drum.

Which of the above statements are correct?
(a) 1 and 2 only (b) 2 and 3 only
(c) 1 and 3 only (d) 1, 2 and 3

54. Ans: (c)

Sol: The main function of a transit mixer is to keep the concrete mix in an agitated condition. Hence, statement 1 is correct.

Transit mixers in addition to the outer spirals have two opposed inner spirals. Hence, statement 2 is incorrect.

A number of special nozzles provided on the lower side of inner mixing spirals, precisely and uniformly spray water on the mix under pressure along the entire length of the drum. Hence, statement 3 is correct.

Hence, option (c) is the correct option.

55. In the acceptance criteria for concrete in accordance with IS 456:2000, the variation in strength of individual specimen should not be more than
(a) ± 30% of the average
(b) ± 25% of the average
(c) ± 15% of the average
(d) ± 20% of the average

55. Ans: (c)

Sol: **IS 456:2000 Clause 15.4**

The test results of the sample shall be the average of the strength of three specimens. The individual variation should not be more than ± 15% of the average. If more, the test results of the sample are invalid. Hence, option (c) is the correct option

56. Which one of the following is NOT required for concrete mix design?
(a) Maximum free water-cement ratio by weight
(b) degree of workability of concrete
(c) Initial setting time of cement
(d) Maximum /minimum cement content

56. Ans: (c)

Sol: For mix design the following are required
- Concrete grade
- Type of cement
- Type of mineral admixture
- Maximum nominal size of aggregate
- Minimum cement concrete
- Maximum water cement ratio
- Workability
- Exposure condition

- Method of concrete placing
- Degree of supervision
- Type of aggregate
- Minimum cement content
- Chemical admixture type

57. Which one of the following statements is NOT correct in respect of wet process of manufacturing of cement?
(a) It requires longer kilns
(b) It produces more homogeneous mix
(c) It is less responsive to a variable clinker demand
(d) It is high cost of excavating and grinding raw materials

57. Ans: (d)

Sol: The chief advantages of the wet process are the low cost of excavating and grinding raw materials, the accurate control of composition and homogeneity of the slurry, and the economical utilization of fuel through the elimination of separated drying operations. On the other hand the longer kilns, essential in the wet process, cost more and are less responsive to a variable clinker demand than the short kilns which can be used in the dry process. Hence, option (d) is the correct option

58. The compaction factor test of cement concrete is performed to determine its
(a) Porosity (b) percentage voids
(c) strength (d) workability

58. Ans: (d)

Sol: Compaction factor test is used to determine the workability of concrete.

59. Which one of the following is obtained by burning kankar or clayey lime-stones?
(a) Hydraulic lime (b) Quick lime
(c) Fat time (d) White lime

59. Ans: (a)

Sol: Fat lime / Pure lime / White lime is obtained by calcination of pure limestone, chalk or seashells. Quick lime is also obtained from limestone. Hydraulic lime is often obtained by the calcination of kankar.
Hence, option (a) is the correct option.

60. Slaked fat lime is used to prepare mortar for
(a) Plastering (b) Masonry construction
(c) pointing (d) reinforced brickwork

60. Ans: (a)

Sol: For plastering works using lime mortar, non-hydraulic lime such as hydrated / slaked fat lime is generally used. Hence, option (a) is the correct option

61. The value of Poisson's ratio for Brass material is
(a) 0.14 (b) 0.24
(c) 0.34 (d) 0.44

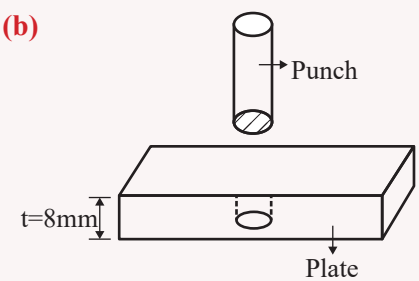
61. Ans: (c)

Sol: $\mu_{brass} = 0.34$

62. A hole is to be punched through a steel plate of 8 mm thickness. What is the least diameter of hole which can be punched, if the steel punch can be worked to a compressive stress of 800 N/mm^2 and the ultimate shear strength is 300 N/mm^2?
(a) 1.2 mm (b) 12 mm
(c) 21 mm (d) 2.1 mm

62. Ans: (b)

Sol:



From statics, $(\text{compressive strength})_{\text{punch}} = (\text{shear strength})_{\text{plate}}$

$\hat{\sigma}_c \times \frac{\pi}{4} d^2 = \hat{\tau} \times \pi dt$

$800 \times \frac{d}{4} = 300 \times 8$

$d = 12$ mm

63. Consider the following statements regarding the strain displacement
1. The strain depends on the displacement of points within the body.
2. The strain at points within the body does not depend on the relative displacements of various points within the body.

Which of the above statements is/are correct?

(a) Both 1 and 2 (b) 1 only
(c) 2 only (d) Neither 1 or 2

63. Ans: (b)

Sol: Statement (1): CORRECT

$$\in = \frac{\Delta \text{ dimension}}{\text{orignal dimension}}$$

Statement (2): Incorrect

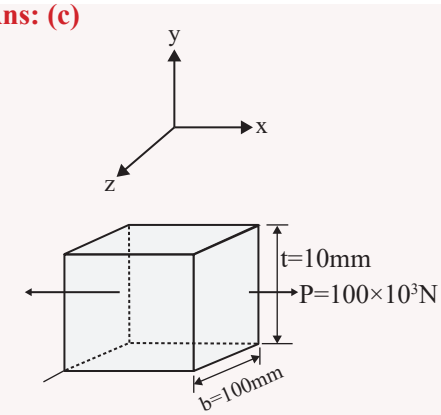
→ Basic assumption in SOM is member is solid and continuous. So the strain at points with in the body depends on the relative displacements of various points with in the body.

64. A flat bar 10 mm thick and 100 mm wide is subjected to a pull of 100 kN. One side of the bar is polished and lines are ruled on it to form a square of 50 mm side, one diagonal of the square being along the middle line of the polished side. What is the change in the sides? (Take E = 200 kN/mm^2 and Poisson's ratio is 0.30)

(a) 0.0875 mm (increases)
(b) 0.00875 mm (decreases)
(c) 0.00875 mm (increases)
(d) 0.0875 mm (decreases)

64. Ans: (c)

Sol:



$$\sigma_x = \frac{P}{A} = \frac{100 \times 10^3}{100 \times 10} = 100 \text{ N/mm}^2$$

$$\in_x = \frac{\sigma_x}{E} = \frac{100}{200 \times 10^3} = 0.5 \times 10^{-3}$$

and $\in_y = \ominus \mu \in_x = \ominus 0.3 \times 0.5 \times 10^{-3} = \ominus 0.15 \times 10^{-3}$

we know

$$\in_{x^1} = \in_{45^\circ} = \in_x \cos^2\theta + \in_y \sin^2\theta + \gamma_{xy} \sin\theta^{0} \cos \times$$

$$\in_{x^1} = (0.5 \times 10^{-3})\cos^2 45^\circ + (-0.15 \times 10^{-3})\sin^2 45^\circ$$

$$\in_{x^1} = \oplus 0.175 \times 10^{-3}$$

$$\therefore \quad \Delta a = a. \in_{x^1} = 50 \times 0.175 \times 10^{-3}$$

$$= \oplus\uparrow 0.00875 \text{ mm}$$

65. In a tensile test carried out in the laboratory on a steel specimen for 5 minutes. The strain value noted at that time was 0.30. What is the average strain rate of that steel specimen?

(a) 0.01/second (b) 0.001/minute
(c) 0.001/second (d) 0.01/minute

65. Ans: (c)

Sol: $\Delta t = 5 \text{ min} = 5 \times 60$ second

$\Delta \in = 0.30$

$$\therefore \in_{avg} = \frac{\Delta \in}{5 \times 60} = 0.001/\text{second}$$

66. Maximum principal strain theory of elastic failure is also known as

(a) Guest's Theory (b) Rankine's Theory
(c) Haigh's Theory (d) Saint Venant's Theory

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66. Ans: (d)

Sol: Maximum principal strain theory → saint venants theory

67. Which one of the following is the limitation of the maximum strain energy theory?
   (a) The theory does not apply to the ductile materials.
   (b) It can only be applicable for the materials under the hydrostatic pressure
   (c) It cannot be applied for materials under the hydrostatic pressure
   (d) The theory does not give accurate results in case of torsion test.

67. Ans: (d)

Sol: Limitation of maximum strain energy theory:

→ Maximum strain energy theory gives considerable experimental support from lists on ductile materials.

But under pure shear conditions, results are unsafe for ductile materials.

$\sigma_1 = \oplus \tau_{max}$

$\sigma_2 = \ominus \tau_{max}$

As per maximum strain energy theory:

$\sigma_1^2 + \sigma_2^2 - 2\mu\,\sigma_1\,\sigma_2 \le \sigma_y^2$

$\tau_{max}^2 + \tau_{max}^2 + 2\mu\,\tau_{max}^2 \le \sigma_y^2$

$$\tau_{max} \le \frac{\sigma_y}{\sqrt{2(1+\mu)}}$$

For ductile material like steel $\mu = 0.3$

$\therefore\ \tau_{max} \le 0.62\,\sigma_y$

But experimental value, $\tau_{max} = 0.57\,\sigma_y$

$\therefore$ unsafe for ductile materials under pure shear.

68. What are the values of maximum shear stress (τ_{max}) and the angle of twist (θ) respectively for an equilateral triangle with side 'a' and twisting moment M_t? (Take the modulus of rigidity is G)

(a) $\frac{20\,M_t}{a^3}$ and $\frac{46\,M_t}{a^4G}$

(b) $\frac{20\,M_t}{a^2}$ and $\frac{26\,M_t}{a^4G}$

(c) $\frac{46\,M_t}{a^3}$ and $\frac{20\,M_t}{a^4G}$

(d) $\frac{20\,M_t}{a^4}$ and $\frac{46\,M_t}{a^3G}$

68. Ans: (a)

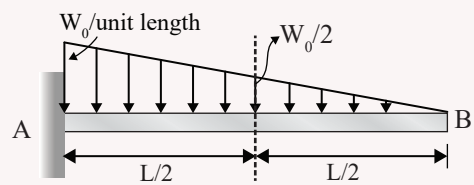
69. A cantilever beam of length L is loaded by a transverse load varying linearly from w_0 at fixed end and zero at free end. What is the shear at L/2 of the beam ?

(a) $w_0\,L/4$ (b) $w_0\,L^2/8$

(c) $w_0\,L^2/4$ (d) $w_0\,L/8$

69. Ans: (d)

Sol:



$F_{@x=\frac{L}{2}}$ = Area of shaded triangle

$$= \frac{1}{2} \times \frac{L}{2} \times \frac{w_0}{2} = \frac{w_0 L}{8}$$

70. Two of the principal stress at a point are 130 MPa and 90 MPa. What is the safe range of the third principal stress at the point by using maximum shear stress theory? (Take the failure stress in tension as $f_y = 210\ N/mm^2$)

(a) $-80\ MPa \leqslant \sigma \leqslant 300\ MPa$

(b) $-155\ MPa \leqslant \sigma \leqslant 210\ MPa$

(c) $-112\ MPa \leqslant \sigma \leqslant 222\ MPa$

(d) $-210\ MPa \leqslant \sigma \leqslant 210\ MPa$

70. Ans: (a)

Sol: $\sigma_1 = 130$,

$\sigma_2 = 90$

$\sigma_3 = ?$

$f_y = 210\ N/mm^2$

As per MSST: $(\tau_{max})_{abs} \le \left(\hat{\tau}_{per} = \frac{f_y}{2}\right)$

$$\max\left\{\left|\frac{\sigma_1-\sigma_2}{2}\right|, \left|\frac{\sigma_2-\sigma_3}{2}\right|, \left|\frac{\sigma_1-\sigma_3}{2}\right|\right\} \le \frac{f_y}{2}$$

Possibility 1:

$$\left|\frac{\sigma_2-\sigma_3}{2}\right| \le \frac{f_y}{2}$$

$|90 - \sigma_3| \le 210$

$\pm(90 - \sqrt{3}) \le 210$

$\sigma_3 \le 300$ (or) $\sigma_3 \ge \ominus 120$

Possibility 2:

$$\left|\frac{\sigma_1-\sigma_3}{2}\right| \le \frac{f_y}{2}$$

$$\left|\frac{130-\sigma_3}{2}\right| \le \frac{210}{2}$$

$\pm (130 - \sigma_3) \le 210$

$\sigma_3 \ge -80$ and $\sigma_3 \le 340$

$\therefore$ Range: $-80\ MPa \le \sigma \le 300\ MPa$

71. A close-coiled helical spring is subjected to an axial pull of W. The spring is made out of 'd' mm diameter rod, and has 'n' complete coils, each of radius R and modulus of rigidity as N then the deflection under the pull is

(a) $\delta = \frac{16\,WR^3\,n}{Nd^4}$ (b) $\delta = \frac{32\,WR^3\,n}{Nd^4}$

(c) $\delta = \frac{64\,WR^3\,n}{Nd^4}$ (d) $\delta = \frac{64\,WR^2\,n}{Nd^3}$

71. Ans: (c)

Sol: $\Delta L_{spring} = \frac{8WD^3n}{Nd^4} = \frac{8W(2R)^3n}{Nd^4} = \frac{64WR^3n}{Nd^4}$

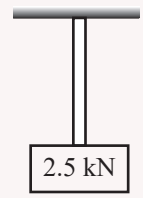
72. A steel wire of cross-sectional area 100 mm^2 and length 100 m is used to lift a weight of 2.5 kN at its lowest end. What is the total elongation of the wire if the mass density of the wire is 8 kg/m^3? (Take E = 200 GPa and acceleration due to gravity is 10 m/s^2)

(a) 14.5 mm (b) 29 mm

(c) 7.5 mm (d) 36.5 mm

72. Ans: (a)

Sol:



$A_{wire} = 100\ mm^2$

$L_{wire} = 100 \times 10^3\ mm$

$P = 2.5 \times 10^3\ N$

$E = 200 \times 10^3\ N/mm^2$

$\rho = 8\ kg/m^3$ (given) $\rightarrow$ error may be

$g = 10\ m/s^2$

$\gamma = \rho g = 80\ N/m^3$

$\Delta L_{total} = (\Delta L)_{due\ to\ P} + (\Delta L)_{self.wt}$

$$= \frac{PL}{EA} \oplus \frac{\gamma L^2}{2E}$$

$$= \left[\frac{2.5 \times 10^3 \times 100 \times 10^3}{200 \times 10^3 \times 100}\right] \oplus \left[\frac{8 \times 10 \times 100^2}{2 \times 200 \times 10^9}\right] \times 10^3 mm$$

$= 12.5 + 0.002 = 12.502$ mm

Nearest correct option (a)

73. For non-homogeneous clays, the coefficient of permeability in (mm/s) should be ranges between

(a) 10^{-1} to 10^{-2} (b) 10^{-2} to 10^{-3}

(c) 10^{-3} to 10^{-4} (d) 10^{-4} to 10^{-6}

73. Ans: (d)

Sol: **Clays:** K = 10^{-4} to 10^{-6} mm/s

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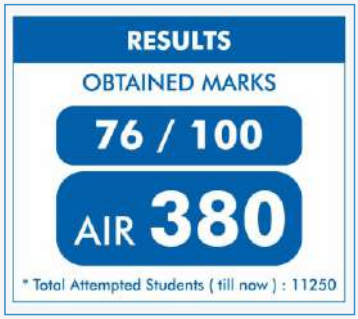

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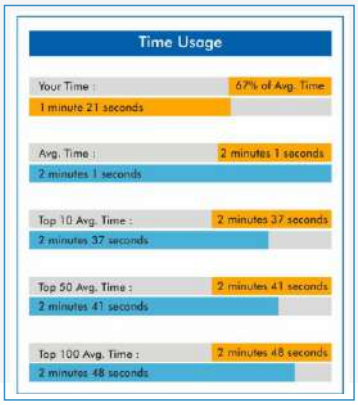

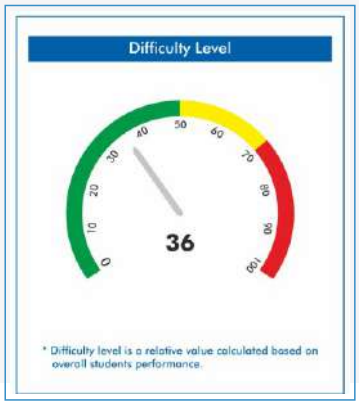

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74. Large parts of northern India lying north of Vindhya-Satpura range in the Indo-Gangetic and Brahmaputra flood plains are covered by
(a) the colluvial soils (b) the aeolian soils
(c) the alluvial soils (d) the talus soils

74. Ans: (c)
Sol: Soils that are formed on flood plains are covered by alluvial soils

75. The maximum test load on a working pile should not exceed
(a) 250 kN
(b) 180 kN
(c) two and a half times the design load
(d) one and a half times the design load

75. Ans:(d)
Sol: Maximum test load on working pile should not exceed 1.5 times of design load

76. Which one of the following does NOT affect the permeability of soils?
(a) Void ratio (b) Soil strength
(c) Grain size (d) Temperature

76. Ans: (b)
Sol: $K = C.D^2.\frac{e^3}{1+e}\frac{\gamma_f}{\mu}$

"K" is independent on strength of soil

77. Consistency is a term used to indicate
(a) the quantitative analysis of soils
(b) the degree of firmness of cohesive soils
(c) the fineness of non-cohesive soils
(d) the fineness of clay soils

77. Ans: (b)
Sol: Consistency or stiffness: Represents degree of firmness of clay soils

78. The primary function of geogrids is
(a) connecting two layers
(b) separators
(c) reinforcement
(d) protection from corrosion

78. Ans: (c)
Sol: Geo grid is a geosynthetic material used to reinforce soils & similar materials, they commonly used to Reinforce retaining walls.

79. Which of the following is/are the laboratory methods of determination of coefficients permeability of soils?
1. Constant head permeability method
2. Falling head permeability method
Select the correct answer using the code given below
(a) 1 only (b) 2 only
(c) Both 1 and 2 (d) Neither 1 nor 2

79. Ans: (c)

80. Which one of the following characteristics is NOT measured by geophysical method of soil exploration?
(a) Magnetism
(b) Density
(c) Electrical resistivity
(d) Plasticity

80. Ans: (d)
Sol: **Geophysical methods**
- Magnetic method
- Seismic reflection/refraction method
- Electrical resistivity method
- Gravity method

Plasticity cannot be measured or characterized by geophysical methods

81. Which one of the following is a method of wet mechanical analysis of a fine-grained material?
(a) Partial sedimentation
(b) Sedimentation into dirty water
(c) Observation of partial sedimented soil
(d) Elutriation

81. Ans: (c)

Sol: Wet mechanical analysis of fine grained soil is based on stoke's law, & conduct by observing partially sedimented soil

82. According to Highway Research Board (HRB) classification system, which one of the following is NOT relevant for dependency of group index of soil?
(a) The amount of material passing the 75-micron IS sieve
(b) The liquid limit
(c) The plastic limit
(d) The shrinkage limit

82. Ans: (d)

Sol: Group Index depends on
(i) % finer than 75μm
(ii) W_L & I_P

83. An oven-dried soil having a mass of 200 g is placed in a pycnometer which is then completely filled with water. The total mass of the pycnometer with water and soil inside is 1605 g. The pycnometer filled with water alone has a mass of 1480 g. What is the specific gravity of the soil?
(a) 2.21 (b) 2.41
(c) 2.67 (d) 3.32

83. Ans: (c)

Sol: $W_{dry\ soil} = 200\ gm = W_2 - W_1$

$W_{soil+water+pycnometre} = 1605\ gm = W_3$

$W_{water+pycnometre} = 1480\ gm = W_4$

$$\therefore G = \frac{W_2 - W_1}{(W_2 - W_1) - (W_3 - W_4)} = \frac{200}{200 - (1605 - 1480)}$$

$$G = \frac{200}{75} = 2.67$$

84. A soil sample has a porosity of 40 percent. The specific gravity of solids is 2.70. What is voids ratio?
(a) 0.467 (b) 0.567
(c) 0.667 (d) 0.743

84. Ans: (c)

Sol: n = 40%, G = 2.7, e = ?

$$e = \frac{n}{1-n} = \frac{0.4}{1-0.4} = \frac{0.4}{0.6} = 0.667$$

85. Which one of the following is used for determining different strata in the earth's crust?
(a) Mine survey
(b) Topographic survey
(c) Archaeological survey
(d) Geological survey

85. Ans: (d)

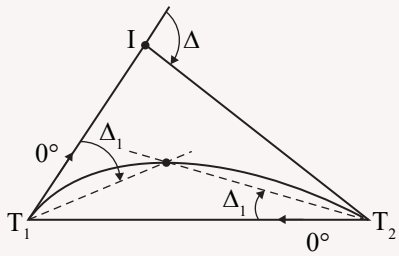
Sol: Geological surveys are conducted to understand the difference types of stratas of earths surface or to understand the stratification of earths surface.

86. Consider the following statements related to set out the curve using two theodolite method
To set out the curve,
1. set up a theodolite over T_1 and another over T_2.
2. set the vernier of each of the instruments to zero.
3. direct the instrument at T_1 to the ranging rod at the point of intersection B and bisect it.

Which of the above statements are correct?
(a) 1 and 2 only (b) 1 and 3 only
(c) 2 and 3 only (d) 1, 2 and 3

86. Ans: (c)

Sol: Two-theodolite method



In two-theodolite method both theodolites at T_1 & T_2 are initially set to read $0^o - 0^o$.

T_1 theodolite is aligned towards point of intersection (I) and T_2 is pointed towards T_1.

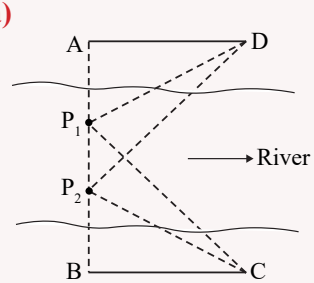
87. In setting out location of piers, the central points of the piers are located by intersection of sights, simultaneous sights being taken from

(a) the ends of a base (b) the top of the pier

(c) the back of the pier (d) the front of the pier

87. Ans: (a)

Sol:



After measuring the length of bridge AB along the plans the piers are located by intersection of sights from the ends of the base line.

88. Which one of the following tapes is generally used for work of the highest precision?

(a) Linen tape

(b) Metric woven metallic tape

(c) Metric steel tape

(d) Invar tape

88. Ans: (d)

Sol:

- Invar tape is used for taking base line measurements in geodetic survey.
- Invar tape is an alloy of Ni (36%) of steel.
- Its coefficient of thermal expansion is only $1/10^{th}$ of steel.

89. A vertical circle which is at right angles to the meridian is also known as

(a) an altitude (b) a co-altitude

(c) a prime vertical (d) an azimuth

89. Ans: (c)

Sol: Logic: options (a), (b)& (d) are angular measurements on celestial sphere.

By elimination approach, correct answer is options (c)

(OR)

Prime vertical is a vertical circle passing through Zenith, Nadir joining celestial east and west directions.

90. Which one of the following is a staff reading taken on a point whose elevation is to be determined?

(a) Fore sight (b) Back sight

(c) Intermediate sight (d) Line of sight

90. Ans: (a)

Sol:

- Both foresight and intermediate sights are necessary for finding elevation of a point.
- But IS are not a necessity for levelling works.
- They are used for detailing.

91. Which one of the following is the source of error in curve computations and layout?

(a) Ability to set on the plates of the theodolite, the required subdivision of a minute for the deflection angles.

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(b) Use of less than full tape-lengths on arc-definition curves.
(c) Carrying out computed elevations to more than 10 mm.
(d) Good intersections between tape line and site line on flat curves.

91. Ans: (b)

Sol: Sources of errors in curve computation
1. Inability to set on the plate of theodolite, the required sub division of a minute for deflection angle.
2. Poor intersection between tape line and site line on flat curve.
3. Use of less than full tape length on arc-definition curves.
4. Carrying out computed elevations to less than 3 mm.
5. Selecting the vertex at other than full stations in vertical curve.

92. Photographic surveying is suitable for
(a) small-scale mapping of open hilly or mountainous countries
(b) flat or wooded country
(c) roads
(d) transmission lines

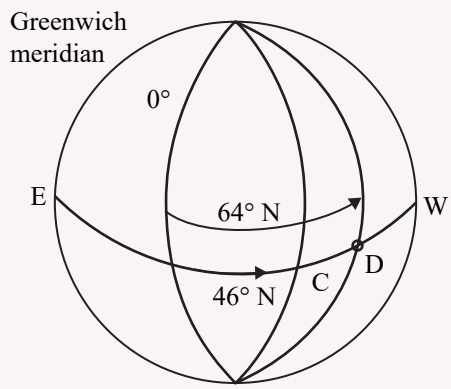
92. Ans: (a)

Sol: Mapping from aerial photograph is the best mapping procedure for large projects interpretation of geology, classification of soil and corps.

93. What is the difference of longitude between two places C and D from the following longitudes?
1. Longitude of C = 46° W
2. Longitude of D = 64° W
(a) 18° (b) 36°
(c) 110° (d) 220°

93. Ans: (a)

Sol:



Difference in longitude = 64° – 46° = 18°

94. If the focal length of lens (f), flying height (H) and height of ground above mean sea level (h) are known, then the scale at height 'h' (S_h) is equal to
(a) f/(H–h) (b) (H–h)/f
(c) (h–H)/2f (d) 2f/(h–H)

94. Ans: (a)

Sol: f → focal length
H → flying height
h → ground elevation
then $S_h = \frac{f}{H-h}$

95. The terrestrial photogrammetry can be divided into how many branches?
(a) Four (b)Three
(c) Two (d) Five

95. Ans: (c)

Sol: Terrestrial photography may be static (stationary object) or dynamic (i.e moving objects)

96. Which one of the following is an aerial photograph taken with the camera axis directed intentionally between the horizontal and the vertical?
(a) Tilted photograph (b) Oblique photograph
(c) Slanting photograph (d) Vertical photograph

96. Ans: (a)

Sol: → If the camera axis is truly vertical it is a vertical photograph.

→ If the camera axis is tilted away from vertical by more than 3^{o} it will be treated as tilted photograph.

97. A plate load test is carried out on submerged soil using a 300 mm radius rigid plate. A load of 5 Tones resulted in a deflection of 1.20 mm. What is the elastic modulus of the soil by considering the Poisson's ratio as 0.50?

(a) 5216 kPa (b) 521.6 GPa

(c) 52.16 MPa (d) 52160 Pa

97. Ans: (c)

Sol: For a rigid plate $\Delta = \frac{1.18Pa}{E_S}$

$\Delta = 1.2$ mm

P = pressure $= \frac{5 \times 1000 \times 10}{\pi \times 0.3^2}$

a = radius of loaded area = 300 mm = 0.3 m

$\therefore \quad E_s = \frac{1.18 \times 5 \times 1000 \times 10}{\pi \times 0.3^2} \times \frac{0.3}{1.2 \times 10^{-3}}$

$= 52.16 \times 10^6$ N/m^2

= 52.16 MPa

98. In case of horizontal curves in pavement, the purpose of super-elevation or banking of curves is to

(a) counteract the centripetal acceleration produced as a vehicle rounds a curve

(b) provide proper cross-drainage

(c) prevent vehicle from sliding inwards

(d) make road look good

98. Ans: (*)

Sol: Super elevation is provided to counteract the centrifugal force and reduce the tendency of vehicle to skid / overturn.

99. Which of the following are the design elements in highway embankments?

1. height
2. fill material
3. settlement

Select the correct answer using the code given below

(a) 1, 2 and 3

(b) 1 and 3 only

(c) 2 and 3 only

(d) 1 and 2 only

99. Ans: (a)

Sol: The design elements in highway embankment arc

i. Height

ii. fill material

iii. settlement

iv. stability of slopes

v. stability of foundation.

100. Consider the following statements related to construction of bituminous pavements

1. It is not possible to construct relatively thin bituminous pavement layers over an existing pavements.
2. In India, the bituminous construction is by and large adopted on the surface course.
3. The black top construction is in extensive use in developing nations.

Which of the above statements are correct?

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

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

100. Ans: (b)

Sol: Thin bituminous layers can be constructed over, existing pavement. Hence it is commonly adopted as wearing course (or) surface course.

101. The held water in subgrade soil forms ice crystals at some spots if the freezing temperatures continue for a certain period. These ice crystals grow further in size if there is a continuous supply of water due to capillary action and the depressed temperature continues. The results in raising of portion of the pavement structure known as
(a) Frost heave
(b) Frost melting
(c) Alternate freeze-thaw cycle
(d) Frost action

101. Ans: (a)

Sol: Frost heave is the upward expansion of pavement surface as the water molecules freeze forming ice due to lower temperatures i.e below freezing point.

102. Consider the following statements related to IRC recommendations for the CBR method of design (IRC:37-1970)
1. The CBR tests should be performed on remoulded soils on the field.
2. For the design of new roads, the subgrade soil sample should be compacted at OMC to proctor density.
3. In new constructions, the CBR test samples may be soaked in water for four days period before testing.

Which of the above statements are correct?
(a) 1 and 2 only (b) 2 and 3 only
(c) 1 and 3 only (d) 1, 2 and 3

102. Ans: (d)

Sol: As per IRC 37 - 1970
i. CBR test should be performed on remolded soil in laboratory. In site tests are not recommended for design purposes.
ii. For the design of new roads, sub grade soil sample should be compacted at OMC to proctor density if suitable equipment is available. If not , available, it may be compacted to dry density.
iii. In new constructions, CBR samples may be soaked in water for four days before testing.
iv. Atleast 3 samples should be tested on each type of soil at same density & moisture content.
v. Top 50 cm of sub grade should be compacted atleast upto 95 to 100% of proctor density etc.

103. Which one of the following measures should be taken for maintaining rolling stock?
(a) The different parts of rolling stock need not be cleaned every day.
(b) All axles completed service life need not be replaced.
(c) The parts of rolling stock which get worn out need not be replaced.
(d) Lubrication of all the reciprocating parts and bearings with a suitable lubricant should be done.

103. Ans: (d)

Sol: General maintenance measure of rolling stock are
i. Lubrication of all reciprocation parts and bearings.
ii. Cleaning/washing of various part of rolling stock every day.
iii. Replacing axles of completed service life.
iv. Replacing worn-out portions of rolling stock from time to time.
v. Maintaining and renewing locomotive boilers.
vi. Reassembling passenger train after useful life.

104. Space-mean speed represents
(a) the instantaneous speed of a vehicle at a specified section or location
(b) the effective speed with which a vehicle traverses a particular route between two terminals

(c) the average speed of vehicles in a certain road length at any time
(d) the average of instantaneous speeds of observed vehicles at the spot.

104. Ans: (c)

Sol: Space-mean speed represents the average speed of vehicle in a certain road length of any time.

105. A vehicle has a wheel base of 6.5 m. What is the off tracking while negotiating a curved path with a mean radius 32 m?
(a) 1.32 m (b) 1.15 m
(c) 0.86 m (d) 0.66 m

105. Ans: (d)

Sol: Off tracking = $\frac{\ell^2}{2R}$

l = 6.5 m

R = 32 m

$\therefore$ Off tracking = $\frac{6.5^2}{2 \times 32}$ = 0.66 m

106. The thickness design of pavement mainly depends on
(a) the pavement materials
(b) the climatic factors
(c) the design wheel load
(d) the subgrade soil

106. Ans: (c)

Sol: Among the various factors, that affect the pavement design, design wheel load is most important.

107. For traffic surveys using origin and destination studies, the most suitable method in case of heavy traffic and absence of skilled or trained personnel is
(a) Road side interview method
(b) License plate method
(c) Work spot or home interview method
(d) Return post card method

107. Ans: (d)

Sol: In road side interview method, work spot or home interview method, personal interviews are conducted to collect origin, designation data. Hence skilled personnel are required and is also not suitable for heavy traffic areas.

In return post card method, post-card with return addresses, containing questionnaire required to be filled is given to road users. Hence it is suitable for heavy traffic areas and also there is no requirement of skilled personnel.

108. In traffic control, the speed at which vehicles are presumed to travel through the coordinated signal system is known as
(a) Signal coordination
(b) Speed of progression
(c) Cycle
(d) Through band

108. Ans: (b)

Sol: The speed at which vehicles are presumed to travel through coordinated signal system is speed of progression.

Signal coordination is the timing of signals in relationship to one another so that vehicles travelling at a predetermined speed can pass through successive green signals.

The space-time path intersecting the green at all signals is called through band.

109. The pressure outside the droplet of water of diameter 0.04 mm is 10.32 N/cm^2 (atmospheric pressure). What is the pressure within the droplet if surface tension is 0.0725 N/m of water?
(a) 11.045 N/cm^2 (b) 10.32 N/cm^2
(c) 9.45 N/cm^2 (d) 8.595 N/cm^2

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109. Ans: (a)

Sol: $(\Delta P)_{Droplet} = \frac{8\sigma}{D}$

$(P_i - 10.32)\ N/cm^2 = \frac{8 \times 0.0725 \frac{N}{cm}}{\frac{100}{0.004\ cm}}$

$\therefore P_i = 11.77\ N/cm^2$

110. What is the viscosity of a liquid whose kinematic viscosity is 6 stokes and specific gravity is 1.90?

(a) 1.14 poise (b) 11.40 poise

(c) 0.114 Ns/m^2 (d) 11.40 Ns/m^2

110. Ans: (b)

Sol: $\upsilon = 6$ stokes $= 6\ cm^2/sec$

$\rho = 1.9$

$\mu = ?$

$\upsilon = \frac{\mu}{\rho}$

$6\frac{cm^2}{sec} = \frac{\mu(poise)}{(1.9)\,(1)\,g/cm^3}$

$\therefore \mu = 11.4$ poise

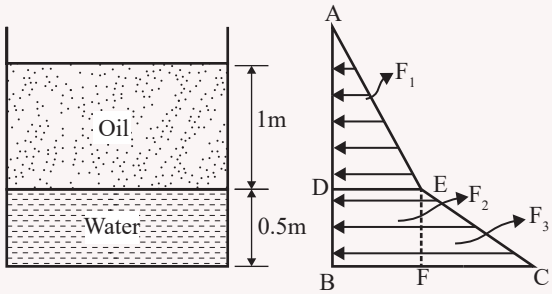
111. A 2 m wide tank contains water upto a height of 0.50 m above its base. An immiscible liquid of specific gravity 0.80 is filled on the top of the water upto 1m height. What is the total pressure force on one side of the tank? (Take density of water as 1000 kg/m^3 and g = 9.81 m/s^2)

(a) 7.85 kN (b) 24.52 kN

(c) 10.3 kN (d) 18.15 kN

111. Ans: (d)

Sol:



F_1 = Area of pressure diagram ADE × width of tank

$F_1 = \frac{1}{2} \times 1 \times (8000 \times 9.81 \times 1) \times 1 \times 2$

$F_2 = \frac{1}{2} \times (7848) \times 2 = 7848$ N

F_3 = Area of triangle EFC × width of tank

$= \frac{1}{2} \times (FC \times EF) \times 2$

$= \frac{1}{2} \times (1000 \times 9.81 \times 0.5)(0.5) \times 2 = 2452.5$ N

Total pressure force on one side

$= 7848 + 7848 + 2452.5$

$= 18148.5\ N = 18.15\ kN$

112. A pipeline of uniformly varying cross section carries on oil of specific gravity 0.87. The diameter of pipe is 200 mm at end A and 500 mm at end B. The end B is located at 4 m higher than A. What is the loss of head in the pipeline if the pressure reading at A is 9.81 N/cm^2 and B is 5.886 N/cm^2? (Take discharge is 200 litres/s and g = 9.81 m/s^2)

(a) 2.609 m (b) 26.09 cm

(c) 2.109 m (d) 21.09 cm

112. Ans: (a)

Sol: Total Energy head of A $= \frac{P_A}{\rho g} + Z_A + \frac{V_A^2}{2g}$

$V_A = Q/A_A = \frac{0.2}{\frac{\pi}{4}(0.2)^2} = 6.396$ m/s

$H_A = \frac{5.886(N/cm^2) \times 10^4}{870 \times 9.81(N/m^3)} + 0 + \frac{(6.369)^2}{2 \times 9.81}$

$= 11.49+0+2.067=13.557$m

$Q = A_A.V_A = A_B.V_B$

Total Energy head at B $= \frac{P_B}{\rho.g} + Z_B + \frac{V_B^2}{2g}$

$= \frac{9.81 \times 10^4 (N/m^2)}{870 \times 9.81(N/m^2)} + 4 + \frac{\left(0.2/\frac{\pi}{4}(0.5)^2\right)^2}{2 \times 9.81}$

$H_B = 6.896 + 4 + 0.052 = 10.948$m

Head loss $(h_L) = H_A - H_B$

$h_L = 13.557 - 10.948 = 2.609$ m

113. Air at standard conditions flows over a flat plate. The free stream speed is 3 m/s. What is the thickness of boundary layer at a distance of 1 m from the leading edge of the flat plate? (Take the kinematic viscosity of air is 1.5×10^{-5} m^2/s and density is 1.23 kg/m^3)

(a) 1.80 mm (b) 1.80 cm

(c) 10.3 cm (d) 10.3 mm

113. Ans: (d)

Sol: $U_\infty = 3$m/s $L = 1$m, $\upsilon_{air} = 1.5 \times 10^{-5}$m^2/s

$\rho_{Air} = 1.23$ kg/m^3

$$R_{eL} = \frac{U_\infty . L}{\upsilon} = \frac{3 \times 1}{1.5 \times 10^{-5}} = 2 \times 10^5 < 5 \times 10^5$$

R_e is critical

Type of boundary is Laminar

$$\delta \propto \frac{L}{\sqrt{R_e}}$$

$$\delta = \frac{4.64 \times 1}{\sqrt{2 \times 10^5}} = 0.0103 \text{ m} = 10.3 \text{ mm}$$

114. The water is flowing with a velocity of 1.5 m/s in a pipe of length 2500 m and diameter 500 mm. A valve is provided at the end of the pipe. What is the rise in pressure if the valve is closed in 25 seconds? (Take velocity of pressure wave is 1460 m/s)

(a) 15 N/cm^2 (b) 1500 N/cm^2

(c) 150 N/m^2 (d) 15 kN/m^2

114. Ans: (a)

Sol: Critical time $= \frac{2L}{C}$

$$T_C = \frac{2 \times 2500}{1460} = 3.42 \text{ sec}$$

Given T = 25 sec

$T > T_C$.

Hence value is closed gradually

Rise in pressure $= \rho . V . \frac{L}{T}$

$$= 1000 \times 1.5 \times \frac{2500}{25}$$

$$= 150000 \text{ N/m}^2 = 15 \text{ N/cm}^2$$

115. The depth of flow of a channel section at which the specific gravity energy is minimum, is called

(a) Critical velocity (b) Critical depth

(c) Critical energy (d) Subcritical flow

115. Ans: (b)

Sol: Critical flow occurs when specific energy is minimum and the depth corresponding to it is Critical depth.

116. Which one of the following statements is correct with respect to Kaplan Turbine?

(a) The peripheral velocity at inlet is more than peripheral velocity at outlet.

(b) Velocity of flow at inlet is more than velocity of flow at outlet.

(c) The peripheral velocity at inlet and outlet are equal

(d) Velocity of flow at outlet is more than velocity of flow at inlet.

116. Ans: (c)

117. The speed of the generator can be maintained constant only if the speed of the turbine runner is constant equal to the one given by equation $N = \frac{60f}{p}$ and is known as

(a) Synchronous speed

(b) Asynchronous speed

(c) Derived speed

(d) Measured variable speed

117. Ans: (a)

Sol: Synchronous speed of electric generator (N) $= \frac{60f}{P}$

Where f = supply frequency

P = number of pairs of poles

118. Consider the following statements related to negative slip of the reciprocating pump

1. The actual discharge of a reciprocating pump is more than the theoretical discharge.

2. The coefficient of discharge will be more than unity.
3. When the suction pipe is short and delivery pipe is long and pump is running at slow speed, then negative slip of the pump occurs.

Which of the above statements are correct?

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

118. Ans: (a)

Sol: Reciprocating pump (negative slip)

1. $Q_{actual} > Q_{the}$
2. $C_D = \frac{Q_{actual}}{Q_{the}} > 1.0$
3. When delivery pipe is short suction pipe is long and pump is running at high speed.
   1 and 2 statement are correct 3rd statement is incorrect.

119. A single acting reciprocating pump has a plunger of diameter 250 mm and stroke of 350 mm. If the speed of the pump is 60 rpm and it delivers 16.5 lit/sec of water against a suction head of 5 m and a delivery head of 20 m, what is the coefficient of discharge?

(a) 0.72 (b) 0.79 (c) 0.86 (d) 0.96

119. Ans: (d)

Sol: Single acting R.P

$d = 0.25$ m $L = 0.35$ m $N = 60$ rpm

$Q_{act} = 16 \times 10–3$ m3/s

$H_s = 5$ km

$\mu_d = 20$ m

$$C_d = \frac{Q_{Add}}{Q_{The}} = \frac{\frac{\pi}{4}(0.25)^2 \times 0.35 \times 60}{60}$$

$= 17.18 \times 10^{-3}$ m^3/sec $= 17.18$ lps

$$C_D = \frac{Q_{Ast}}{Q_{The}} = \frac{16.5}{17.18} = 0.96$$

120. The stream function is given by the expression $\psi = 2x^2 – y^2$. What is the resultant velocity at a point denoted by $x = 2$ and $y = 3$?

(a) 10 (b) 12
(c) 15 (d) 18

120. Ans: (a)

Sol: Strain function $\psi = 2x^2 – y^2$

$V_{(2,3)} = ?$

$$U = \frac{\partial \psi}{\partial y} = – 2y = – 2 \times 3 = – 6 \text{ Units}$$

$$V = – \frac{\partial \psi}{\partial x} = – 4x = – 4 \times 2 = – 8 \text{ Units}$$

Resultant velocity $= \sqrt{U^2 + V^2}$

$= \sqrt{(– 6)^2 + (– 8)^2}$

$= \sqrt{36 + 64}$

$= \sqrt{100} = 10$ Units

121. A catchment has six rain gauge stations. In a year, the annual rainfall recorded by the gauges are as follows

Station	A	B	C	D	E	F
Rainfall (cm)	82.6	102.9	180.3	110.3	98.3	136.7

For a 10% error in the estimation of the mean rainfall, what is the optimum number of stations in the catchment? (Take $\bar{P} = 118.6$, $\sigma_{m-1} = 35.04$ and $\varepsilon = 10$)

(a) 10 (b) 9
(c) 8 (d) 7

121. Ans:(b)

Sol: $\bar{P} = 118.6$

$m = 6$

$\sigma = 35.04$

$\varepsilon = 10$

$$C_v = \frac{100 \times \sigma}{\bar{P}} = \frac{100 \times 35.04}{118.6} = 29.544$$

Optimum number of rain gauges $n = \left[\frac{C_v}{E}\right]^2$

$$= \left[\frac{29.544}{10}\right]^2 = 8.725 \simeq 9$$

122. Which one of the following is defined as the process by which the water leaves a living plant during photosynthesis, through its leaves, to enter the atmosphere as water vapour?
(a) Transpiration (b) Evapotranspiration
(c) Stomata (d) Evaporation

122. Ans: (a)

Sol: Water leaves the living plant and diffuse in the atmosphere through stomata openings during photosynthesis is known as transpiration.

123. Which one of the following is a gap developed in the canal bank due to erosion of some portion of the bank?
(a) Canal breach
(b) Sub canal
(c) Temporary outlet used for irrigation
(d) Fault

123. Ans: (a)

Sol: Canal breach is the gap developed in the canal bank due to erosion of some portion of bank.

124. Which one of the following stages does the river bed consist of a mixture of boulders, gravels, shingles and alluvial sand deposits created by itself?
(a) Rocky stage
(b) Incised river stage
(c) Boulder river stage
(d) Rivers in alluvial flood plains stage

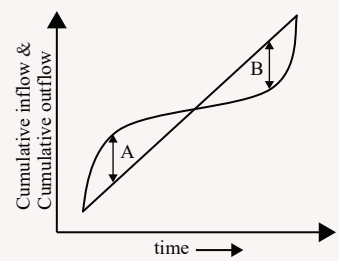
124. Ans: (c)

Sol: Boulder stage: Bed is made up of sand, gravel, shingles and boulders.

125. Which of the following are the only two factors which govern the storage capacity of the reservoir?
(a) Inflow to reservoir and the outflow from the reservoir.
(b) Inflow and catchment area
(c) Catchment area and outflow
(d) Height of reservoir and catchment area

125. Ans: (a)

Sol: Storage capacity of reservoir depend on inflow and out flow from reservoir which is found by plotting mass curve of inflow and outflow.



Storage capacity: maximum deficit A + maximum surplus B

126. Formation of successive bends of reverse order may lead to the formation of a complete S curve called
(a) Concave or outer edge
(b) Scouring
(c) Meander
(d) Convex or inner edge

126. Ans: (c)

Sol: River (or) stream taking curvature is knows as meandering river.

127. The monthly consumptive use values for paddy are tabulated below. What is average monthly consumptive use?

Month	Dates	Rice (Loan Soil C_u in cm
June	1 - 30 } Nursery	29.69
July	1 - 12 } Nursery	8.76
July	13-31	14.38
August	1-31	22.73
September	1-30	21.29
October	1-31	25.50
November	1-24	15.06

(a) 7.7 cm (b) 23.1 cm
(c) 26.69 cm (d) 137.41 cm

127. Ans: (b)

Sol: Total number of days =

$30 + 31 + 31 + 30 + 31 + 24 = 177$ days

$$\frac{177 \text{ days}}{30} = 5.9 \text{ months}$$

Total consumptive use in 5.9 months

$$= \left[\frac{29.69 + 8.76 + 14.38 + 22.73 + 21.21 + 25.5 + 15.06}{5.9}\right]$$

$= 23.2 \simeq 23.1$ cm

128. Water bearing stratum, having no confined impermeable over burden lying over it, is known as
(a) An unconfined aquifer
(b) An artesian aquifer
(c) Confined aquifer
(d) Controlled aquifer

128. Ans: (a)

Sol: Water bearing stratum not over lined by impervious strata is known as unconfined aquifer.

129. The permeable groynes made from timber stakes or wooden piles, are called
(a) Balli spurs (b) Tree spurs
(c) Balli crates (d) Wire crates

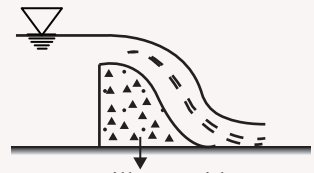
129. Ans: (a)

Sol: Timber stakes or wooden piles are used in Balli spurs stone fillings will be used in Balli crates.

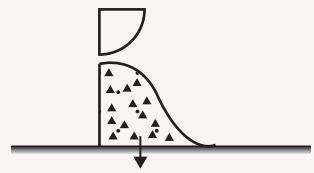
130. A reservoir with uncontrolled and ungated outlets is known as
(a) Retarding basin (b) Storage reservoir
(c) Controlled reservoir (d) Detention basin

130. Ans: (a)

Sol: A reservoir with uncontrolled and ungated outlet is know as retarding begin.



Spillway without gates uncontrolled reservoir



Spillway with gates controlled reservoir

131. The distance between the outer edges of clockwise and anti-clockwise loops of the meander
(a) Meander length (b) Meander belt
(c) Meander ratio (d) Cross-overs

131. Ans: (b)

Sol: Meander belt (or) Meander width is the distance between outer edges of clockwise and anticlockwise loops of meander.

132. Which one of the following is the one which rests in a previous stratum and draws its supply from the surrounding material?
(a) Sidetrack well (b) Horizontal well
(c) Deep well (b) Shallow well

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AIR 9  ARPIT JAIN CE

AIR 10  HEMABH TRIVEDI ME

AIR 10  RAJAT DIXIT EE

AIR 10  L KUMARI JAISWAL E&T

AIR 10  AMIT SHARMA CE

and many more...

TOTAL 36 RANKS IN TOP 10

ME	EE	E&T	CE
10	09	10	07

132. Ans: (d)

Sol: Shallow open wells are those which rest in top water bearing strata and draw their supply from the surrounding material.

133. The various types of water demand, which a city may have, may be broken down into which of the following classes?
1. Domestic water demand
2. Industrial water demand
3. Demand for public uses

Select the correct answer using the code given below
(a) 1 and 2 only (b) 2 and 3 only
(c) 1 and 3 only (d) 1, 2 and 3

133. Ans: (d)

Sol: **Various types of water demands**
1. Domestic water demand
2. Industrial water demand
3. Institution and commercial water demand
4. Demands for public uses
5. Fire demand
6. Water required to compensate losses in waste & theft.

134. In a big city having population of 50 lakhs, if 6 moderate fires each of 3 hours break out in a day, what is the approximate amount of water required per person per day? (Assume 3 jet streams simultaneously throwing water from a hydrant with discharge of 1100 litres/minute/stream)
(a) less than 1 litre (b) between 1-3 litres
(c) between 3-5 litres (d) 20 litres

134. Ans: (a)

Sol: For 3 streams, for 3 hours, for 1 fire $=1100 \times 60 \times 3$
For 6 fires $= 6 \times 3 \times 1100 \times 60 \times 3 = 35,64,000$ litre

$$\text{per captia/day} = \frac{35,64000}{500000} = 0.71\ l/c/d$$

135. For water supply scheme design of a town or a city, the suitable method of estimating future population by the end of the design period is
(a) increasing rate method
(b) decreasing rate method
(c) exponential curve method
(d) incremental decrease method

135. Ans: (b)

136. Which one of the following is NOT a factor affecting losses and wastes in water supply scheme?
(a) Metering
(b) Unauthorised connections
(c) Water demand
(d) Pressure in the distribution system

136. Ans: (c)

Sol: Factor affecting losses and waste
1. Water fight joints
2. Pressure in distribution system
3. System of supply
4. Metering
5. Unauthorized connection

137. Which one of the following forecasting methods for population is also known as uniform increase method?
(a) Arithmetic increase method
(b) Decreasing rate method
(c) Geometric increase method
(d) Simple geographical method

137. Ans: (c)

Sol: Geometric increase method is called as uniform increase method. Growth rate is consider as constant.

138. Storage capacity of a reservoir can be estimated by using
(a) Cuboidal formula (b) Cylindrical formula
(c) Prismoidal formula (d) Conical formula

138. Ans: (c)

Sol: Storage capacity of reservoir can be estimated by using prismoidal.

$$V = \frac{h}{3}(A_1 + A_n) + 2(A_2 + A_4 \ldots,) + 4(A_3 + A_5 \ldots A_{n-2}))$$

139. Modern commercial turbidimeter which works on the principle of scattering of light at right angles to the incident light, is called
(a) Spectrometer (b) Nephelometer
(c) Optimeter (d) Lightmeter

139. Ans: (b)

Sol: **a. Spectrometer:** Light absorption, transmittance
b. Nephelometer: Measures the concentration of suspended particulate. [Light beam & light detector set to one side (after 90º) of source]
c. Optimeter: Amount of water absorbed equals to amount of water transpired.
d. Light meter: Amount of light falling on a subject (incident light) or being reflected by a subject.

140. Which one of the following is a disease caused by protozoal infections under water-borne disease?
(a) Infectious hepatitis (b) Amoebic dysentery
(c) Infectious jaundice (d) Poliomyelitis

140. Ans: (b)

Sol: Water borne disease
Due to bacterial infection
1. Typhoid fever d paratyphoid fever
2. Cholera
3. Bacillary dysentery

Due to Viral
1. Infection hepatitis or jaundice
2. Poliomyellitis (Polio virus)

Due to protozoal infection
1. Amoebic dysentry

141. Which of the following methods adopted for purifying the public water supplies?
1. Screening
2. Sedimentation aided with coagulation
3. Disinfection
Select the correct answer using the code given below
(a) 1 and 2 only (b) 2 and 3 only
(c) 1 and 3 only (d) 1, 2 and 3

141. Ans: (d)

142. According to Stoke's law, if the diameter (d) is less than 0.1 mm, then the settling velocity of spherical particles is directly proportional to
(a) d^2 (b) d^3
(c) d (d) $d^{1/2}$

142. Ans: (a)

Sol: Stoke's law:
At equilibrium

$$w = F_{Drag} + F_{buoyancy}$$

$$\rho_{solid}.g.\frac{4}{3}\pi r^3 = 6\pi\mu.r.V + \rho_{liquid}g\frac{4}{3}\pi r^3$$

where

$$[F_{Drag} = \frac{1}{2}C_D.\rho.AV^2]$$

$$C_D = \frac{24}{Re} \text{ for Stoke's valid}$$
$$= 6\pi\mu rV$$

$$\therefore V = \frac{(\rho_{solid} - \rho_{liquid})\frac{4}{3}\pi r^3}{6\pi.\mu.r}$$

$$V \propto r^2 \Rightarrow V \propto d^2$$

143. What is the settling velocity of a discrete particle in water under conditions when Reynold's number is less than 0.5? (Take the diameter and specific gravity of the particle are 5×10^{-3} cm and 2.65 respectively and Kinematic viscosity of water at 20°C is 1.01×10^{-2} cm²/s and g = 9.81 m/s²)

(a) 0.22 cm/s (b) 0.35 cm/s

(c) 0.14 cm/s (d) 0.46 cm/s

143. Ans: (a)

Sol: $V_s = \dfrac{(G-1)g\rho_w d^2}{18\mu}$

$\dfrac{(G-1)\rho_w d^2}{18\nu}$

$V_s = \dfrac{(2.65-1)\times 9.81\times (5\times 10^{-3})^2}{1.8\times 1.01\times 10^{-2}}$

$V_s = \dfrac{1.65\times 9.81\times 25\times 10^{-6}}{18\times 1.01\times 10^{-2}}$

$V_s = 0.22$ cm/s

(or)

$V_s = 418 \times (G-1)\, d^2 \left(\dfrac{3T+70}{100}\right)$

$V_s = 418 \times (2.65-1) \times (5\times 10^{-2})^2 \times \left(\dfrac{3\times 20+70}{100}\right)$

$= 418 \times 1.65 \times 25 \times 10^{-4} \times 1.3$

$V_s = 2.24$ mm/sec

$V_s = 0.22$ mm/sec

144. The rate of filtration of pressure filter as compared to rapid gravity filter is about

(a) 10 times (b) 15 times

(c) 2 to 5 times (d) 6 to 8 times

144. Ans: (c)

Sol: Pressure filter = 6000 – 15000 *l*/h/m²

Rapid filter = 3000 – 6000 *l*/h/m²

Directions : Each of the next six (06) items consists of two statements, one labelled as the 'Statement (I) and the other as 'Statement (II). You are to examine these two statements carefully and select the answer 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 Statement (1)

(b) Both Statement (1) and Statement((II) are individually true, but Statement (II)is not the correct explanation Statement (I)

(c) Statement (D) is true, but Statement (II) is false

(d) Statement (I) is false, but Statement (II) is true

145. **Statement (I):** The stone should be well seasoned.

Statement (II): The resistances of stone against the wear and tear due to natural agencies should be high.

145. Ans: (b)

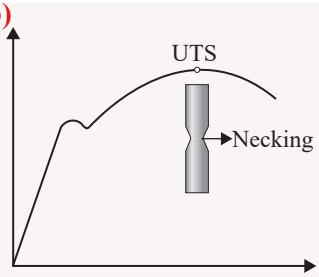
Sol: Statement (I) is related to property of a good building stone regarding its seasoning, while Statement (II) is related to property of a good building stone regarding its weathering. Both the statements are correct, but Statement (II) is not the correct explanation for Statement (I). Hence, option (b) is the correct option

146. **Statement (I):** The tensile strength (or ultimate strength) is defined as the highest value of the engineering stress.

Statement (II): For ductile materials, the tensile strength corresponds to the point at which necking starts.

146. Ans: (b)

Sol:



Statement (I): UTS is highest value of Engg. stress → CORRECT

Statement (II): @ UTS necking initiating in member → CORRECT

→ Both statement (I) and statement (II) is are individually true but statement (II) is not the correct explanation of statement (I).

147. **Statement (I):** The use of slope deflection method is limited to structures which are not highly indeterminate.

Statement (II): The slope deflection equations can be obtained by using the principle of superposition by considering separately the moments developed at each support due to each of the displacements, and then the loads.

147. Ans: (b)

Sol: If the number of unknowns are more, equations required more. This method rot suitable if number of unknown are more.

The slope deflection equations can be obtained by using the principle of super portion by considering separately the moments developed at each support due to each of the displacement and then the loads.

148. **Statement (I):** In the partial safety factor-based design format, the design capacity is defined by considering the corresponding partial safety factor.

Statement (II): The partial safety factors are associated with the inherent and modeling uncertainties.

148. Ans: (a)

149. **Statement (I):** The theory of reinforced concrete is developed with the assumption that there is perfect bond between steel and concrete, in other words,t here is no slip.

Statement (II): In case of ribbed bars, there is no need to check the bond failures.

149. Ans: (c)

Sol: **Statement (I): True**

Bond between steel and concrete must be effective such that the steel bar not slipped from concrete.

It is one of the assumption in reinforced concrete design.

Statement (II): False

Deformed bars may be used without end anchorages provided development length requirement is satisfied.

150. **Statement (I):** The boundary layer thickness decreases as the distance from the leading edge increases.

Statement (II): Greater is the kinematic viscosity of the fluid greater is the boundary layer thickness.

150. Ans: (a)

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