LIVE

Question Paper Discussion

ASSISTANT PROFESSOR IN CIVIL ENGINEERING

Technical Education Dept. (Engg. Colleges)

Category No : 722/2021

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ASSISTANT PROFESSOR IN CIVIL ENGG.
Technical Education Department (Engineering Colleges)

Sl.No	Subject	Marks
1	Engineering Mechanics	4
2	Mechanics of solids	5
3	Concrete technology	6
4	Surveying	5
5	Geotechnical engineering	17
6	Fluid Mechanics	5

Sl.No	Subject	Marks
7	Water Resources engineering	9
8	Transportation engineering	15
9	Environmental engineering	15
10	RCC and Steel	9
11	Estimation	5
12	SA	5

1. The number of independent equations to be satisfied for static equilibrium in a space structure is

A. 3

B. 4

C. 2

D. 6

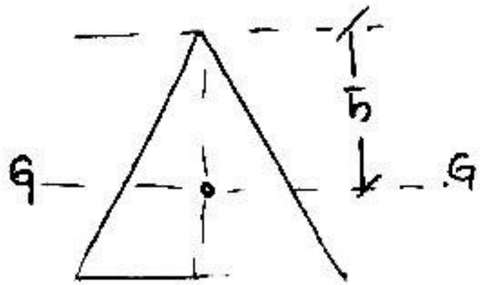
2. The moment of inertia of a triangle of base b and height h about an axis through its centroid is $bh^3/36$. The moment of inertia about a parallel axis passing through the vertex of the triangle is

A. $bh^3/2$

B. bh^3

C. $bh^3/4$

D. $bh^3/12$



$$I_G = \frac{bh^3}{36}$$

Moment of Inertia about vertex $= I_G + A\bar{h}^2$

$$= \frac{bh^3}{36} + \frac{1}{2} \times b \times h \times \left(\frac{2h}{3}\right)^2$$

$$= \frac{bh^3}{36} + \frac{bh^3}{2 \times 9} \times 4$$

$$= \frac{bh^3}{4}$$

3. A general system of forces acting on a rigid body can be replaced by:

   A. Force vector and couple moment vector at a point

   B. Single force vector

   C. Single couple moment vector

   D. Null vector

4. Concurrent forces are those forces whose line of action:

A. Meet at a point

B. Meet at a same plane

C. Are parallel to each other

D. None of the above

5. The polar moment of inertia of rectangular section having width 2cm and depth 6cm is

A. 30 cm^4

B. 50 cm^4

C. 40 cm^4

D. None

Polar moment of Inertia = $I_{xx} + I_{yy}$

$b = 2$

$d = 6$

$$= \frac{bd^3}{12} + \frac{db^3}{12}$$

$$= \frac{2 \times 6^3}{12} + \frac{6 \times 2^3}{12}$$

$$= \frac{2 \times 6 \times 6 \times 6}{12} + \frac{6 \times 2 \times 2 \times 2}{12}$$

$$= 36 + 4 = 40 \text{ cm}^4$$

6. A cable 20mm diameter and 10 m long is pulled by a force of 5000 πN. If the modulus of elasticity is 2 $\times 10^5$ N/mm^2, the elongation is

A. 2 mm

B. 2.5 mm

C. 5 mm

D. 5.5 mm

$$\Delta L = \frac{PL}{AE}$$

$$= \frac{5000\pi \times 10 \times 1000}{\frac{\pi}{4} \times 20^2 \times 2 \times 10^5} = 2.5\,mm$$

7. If the modulus of elasticity is twice that of shear modulus, then the Poison's ratio of the material is

A. 0

B. 0.2

C. 0.4

D. 0.5

Given,

$$E = 2G$$

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

$$2G = 2G(1+\mu)$$

$$1+\mu = 1$$

$$\mu = 0$$

8. A homogeneous, simply supported prismatic beam of width B, depth D and span L is subjected to a concentrated load of magnitude P. The load can be placed anywhere along the span of the beam. The maximum flexural stress developed in beam is :

A. $2PL/3BD^2$

B. $3PL/4BD^2$

C. $4PL/3BD^2$

D. $3PL/2BD^2$

$$BM_{max} = \frac{PL}{4}$$

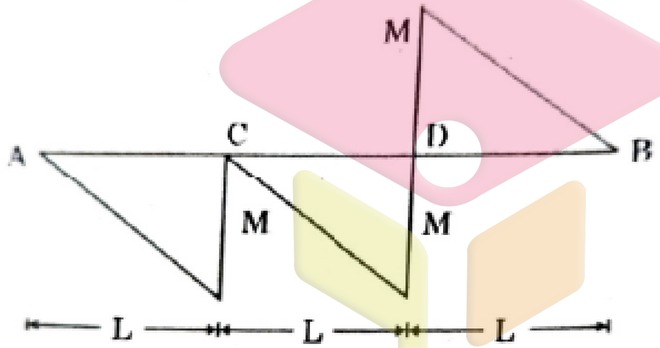
(max BM occurs when load is @ center)

$$f = \frac{M}{I} y$$

$$= \frac{PL}{4 \times BD^3} 12 \times \frac{D}{2}$$

$$= \frac{3}{2} \frac{PL}{BD^2}$$

9. A simply supported beam AB has the bending moment diagram as shown in the following figure. The beam is possibly under the action of following loads



A. Couples of M at C and 2M at D

B. Couples of 2M at C and M at D

C. Concentrated loads of M/L at C and 2M/L at D

D. Concentrated loads of M/L at C and couple of 2M at D

10. In a section, shear centre is a point through which, if the resultant load passes, the section will not be subjected to any

A. Bending
B. Tension
C. Compression
D. Torsion

11. As the cube size increases, the strength of concrete:

A. Decreases

B. Remains constant

C. Increases

D. Insufficient data

12. The early high strength of rapid hardening cement is due to its :

A. Increased content of gypsum

B. Burning at high temperature

C. Increased content of cement

D. Higher content of tricalcium silcate

13. Los Angeles machine is used to test the aggregate for

A. Crushing strength

B. Impact value

C. Abrasion resistance

D. Water absorption

14. According to IS:383, the coarsest sand falls under which grading zone?

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

15. Gypsum is typically added in cement to

A. Control setting time
B. Control workability
C. Control heat of hydration
D. Increase strength

16. The volume of the cement required for 10 m^3 of brickwork in 1: 6 cement mortar is approammately equal to :

A. 3/7 m^3

B. 3/6 m^3

C. 3/4 m^3

D. 3/5 m^3

Volume of cement $= 10 \times 0.23 \times 1.33 \times \frac{1}{(1+6)}$

$= \frac{3}{7} m^3$

17. Estimate the quantity of brick masonry required for construction of a room of 4m × 3m internal dimensions. Thickness of wall should be 250 mm. Two windows of 2m × 1.5m and one door of 1.5 m x 2.2 m is to be provided to the room. Height between the top of plinth beam and bottom of slab beam should be 4m :

A. 9.420 m^3

B. 12.675 m^3

C. 13.920 m^3

D. 15.925 m^3

Total Length of wall

$= (4.25 \times 2) + (3.25 \times 2) = \underline{15}\ m$

Volume of windows and door

$= 2(2 \times 1.5 \times 0.25) + (1.8 \times 2.2 \times 0.25)$

$= \underline{2.325\ m^3}$

Volume of BW $= (15 \times 0.25 \times 4) - 2.325$

$= \underline{12.675\ m^3}$

18. A test facility setup costs Rs. 10,00,000/- at the time installation and its scrap values is Rs. 50,000 at the end of the useful life in 10 years. Adopting a straight line method for computation of depreciation, estimate the book value of the facility at the end of five years:

A. Rs. 4,75,000

B. Rs. 5,00,000

C. Rs. 5,25,000

D. Rs. 5,75,000

$$D = \frac{C-S}{n} = \frac{10,000,00 - 50,000}{10}$$

$$= \frac{950,000}{10} = 95000$$

Total depreciation amount for 5 yrs

$$= 95000 \times 5$$

$$= 475,000$$

$\therefore$ Book value $= 10,00,000 - 475000$

$$= 525000$$

19. A residential building is constructed at a cost of Rs 1,75,000/-, The total outgoing including sinking fund is Rs. 11,500/- per annum. If the owner desires 5% return on construction. then the gross monthly rent of the property is :

A. Rs. 20,250.00

B. Rs. 8,750.00

C. Rs. 1,687.50

D. Rs. 730.00

$$\text{Net rent} = \frac{\text{Cost}}{\text{Year's purchase}}$$

$$= \frac{1,75000}{100/5}$$

$$= 8750$$

Gross rent = Net rent + outgoings = 8750 + 11500

= 20,250

Gross monthly rent = $\frac{20 \times 250}{2}$ = 1687.5

20. The usable part of liveable area of a building is also known as :

A. Carpet area

B. Circulation area

C. Horizontal circulation area

D. Plinth area

21. There are ten instrument stations occupied in succession during a traverse survey. An observer makes equal error in each station, the magnitude of which is 80 in each instance at all the stations. What is the probable error of the final bearing at the end of the traverse?

A. $\pm 10\ \delta\theta$

B. $\pm 100\ (\delta\theta)^2$

C. $\pm 10\ \sqrt{\delta\theta}$

D. $\pm\ \delta\theta\ \sqrt{10}$

22. In a closed traverse with five sides, the error found from the fore bearing and back bearing of the last line is +2°. The correction to the third line will be :

A. 0°24'

B. 0°48'

C. 1°12'

D. 1°36'

23. Which one of the following statements is correct?

A. In a retrograde vernier (n- 1) divisions on the primary scale are divided into n divisions on the vernier scale

B. A double vernier consists of two simple verniers placed end-to-end forming one scale with the zero in the centre

C. In an extended vernier, (2n +1) primary divisions are divided into n divisions on the vernier

D. In a direct vernier, (n +1) primary divisions are divided into n equal divisions on the vernier scale

24. A surveyor measures a distance between two points on a map of representative fraction 1:100 is 60 m. But later he found that he used a wrong representative fraction of 1:50. What is the correct distance between the two points?

A. 30 m

B. 90 m

C. 45 m

D. 120 m

25. The reduced bearing of a 10 m long line in N 30°E. The departure of the line is:

A. 10 m

B. 8.66 m

C. 7.52 m

D. 5.00 m

departure of Line $= l \sin\theta$

$= 10 \sin 30$

$= 10 \times 1/2$

$= \underline{5\ m}$

26. The liquid limit of a saturated normally consolidated soil is 50%. The compression index of the for the virgin compression curve will be:

A. 0.36

B. 0.505

C. 0.005

D. 0.705

for undisturbed soil,

$$\text{Compression Index} = 0.009(w_L - 10)$$

$$= 0.009(50 - 10)$$

$$= \underline{\underline{0.36}}$$

27. The maximum theoretical value of dry density or the saturation dry density at any particular degree of saturation can be computed as:

A. $\gamma_d \frac{G\gamma_w}{1+e}$

B. $\gamma_d \frac{G\gamma_w}{1+wG}$

C. $\gamma_d \frac{(G+e)\gamma_w}{1+e}$

D. $\gamma_d \frac{G(1-\square_v)\gamma_w}{s+wG}$

28. The distance from the surface of the clay particle to the limit of attraction is termed as:

A. Bipolar distance

B. Rigid layer

C. Diffuse Double layer

D. Specific surface

29. The terminal velocity of a particle in suspension is given by the equation

A. $v = \frac{D^2(\gamma_s - \gamma_w)}{18\eta}$

B. $v = \frac{18\eta D^2}{(\gamma_s - \gamma_w)}$

C. $v = \sqrt{\frac{18\eta D^2}{(\gamma_s - \gamma_w)}}$

D. $v = \sqrt{\frac{D^2(\gamma_s - \gamma_w)}{18\eta}}$

30. A clay is identified as normal Clay if the activity range is between

A. 0:25 to 0.75

B. 0.75 to 1.25

C. 1.25 to 3

D. 0.15 to 0.25

31. The permeability in the case of fine grained soil is related to the particle size as

A. $k = CD^2$

B. $k = CD^3$

C. $K = \frac{C}{D^2}$

D. $K = \frac{C}{D^3}$

32. At the toe of a dam the foundation soil has a porosity of 42%. If the specific gravity of the soil solids is 2 65. Determine the critical hydraulic gradient:

A. 1.16

B. 0.96

C. 0.86

D. 1.04

$$e = \frac{n}{1-n} = \frac{42}{100-58}$$

$$= 72\% = 0.72$$

$$I_c = \frac{G-1}{1+e}$$

$$= \frac{2.65-1}{1+0.72}$$

$$= 0.96$$

33. The vertical stress at a depth ‘z’ under the centre of a circular area of diameter ‘2α’ and load intensity 'q‘ is given by:

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

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

C. $\sigma_z = q\left[1+\left\{\frac{1}{1+\left(\frac{a}{z}\right)^2}\right\}^{3/2}\right]$

D. $\sigma_z = q\left[1-\left\{\frac{1}{1-\left(\frac{a}{z}\right)^2}\right\}^{3/2}\right]$

34. A retaining wall of 5m high retains dry sand with an angle of friction of 30° and saturated unit weight of sand is 20kN/m^2. If the water table rises to the top of the wall, determine effective thrust at rest condition:

A. 125 kN/m

B. 0 kN/m

C. 50 kN/m

D. 100 kN/m

Effective thrust @ Rest

$K_a = 1 - \sin\phi$

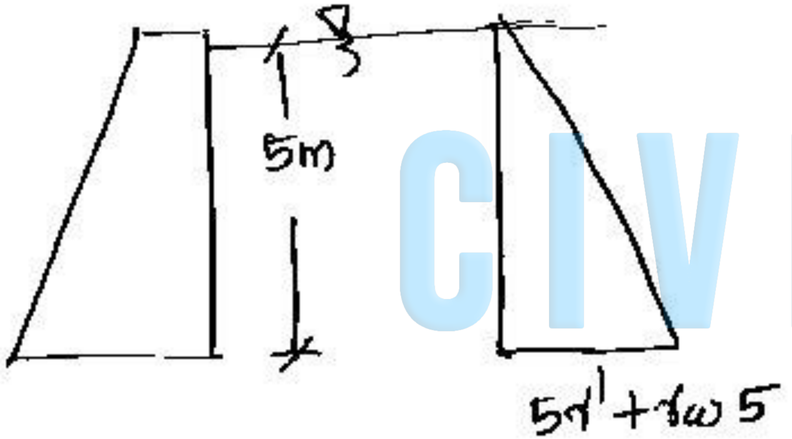
$= 1 - 0.5$

$= 0.5$

$P_0 = 0.5 \times 5 \times 10 + 10 \times 5$

$= 25 + 50$

$= 75 \text{ kN/m}^2$



Thrust $= \frac{1}{2} \times 75 \times 5$

$= 187.5 \text{ kN/m}$

35. Point bearing or tip resistance of bored piles in sand is

A. 1/4 to 1/5 of driven pile

B. 1/2 to 1/3 of driven pile

C. 2 to 3 times of driven pale

D. 1/6 to 1/8 of driven pile

36. The straight line representing successive state of stress in a test specimen of soil during loading and unloading is

A. Critical path

B. Failure envelope

C. Stress path

D. Drained path

37. In order to minimise sampling disturbance the area ratio should be:

A. Zero

B. As high as possible

C. As low as possible

D. Equal to unity

38. The ultimate bearing capacity of a strip footing is reduced by 50% when the position ground water table is at:

A. Base of the footing

B. The ground surface

C. A depth D =1.5 B

D. A depth D = 0.5 B

39. According to Terzaghi the curved surface of sliding in the passive case approximates to a

A. Parabola

B. Hyperbola

C. Friction Circle

D. Logarithmic spiral

40. The depth of tension crack in cohesive soil is given by:

A. $\frac{2C}{\gamma\sqrt{K_\alpha}}$

B. $\frac{2C}{\gamma}$

C. $\frac{4C}{\gamma\sqrt{K_\alpha}}$

D. $\frac{4C}{\gamma}$

41. A two span continuous beam ABC, with uniform flexural rigidity, is provided with fixed support at A and hinged supports at B and C. If AB = 4 m and BC= 3 m the distribution factors for BA and BC respectively are:

A. 0.6 and 0.4

B. 0.4 and 0.6

C. 0.5 and 0.5

D. 0.75 and 0.25

Fixed support,

$$K = \frac{4EI}{L}$$

Hinged support,

$$K = \frac{3EI}{L}$$

For AB, $K_{AB} = \frac{4 \times EI}{4} = \underline{EI}$

For BC = $K_{BC} = \frac{3EI}{3} = \underline{EI}$

DF of BA = $\frac{K_{AB}}{\Sigma k} = \frac{EI}{2EI} = \underline{0.5}$

DF of BC = $\frac{K_{BC}}{\Sigma k} = \underline{0.5}$

42. The sag tie of a roof truss is subjected to

A. Tension

B. Compression

C. Shear

D. None of these

43. The state and kinematic indeterminacy of a single bay single storey portal frame, with fixed base, respectively are

A. 3 and 3

B. 3 and 6

C. 6 and 3

D. 3 and 2

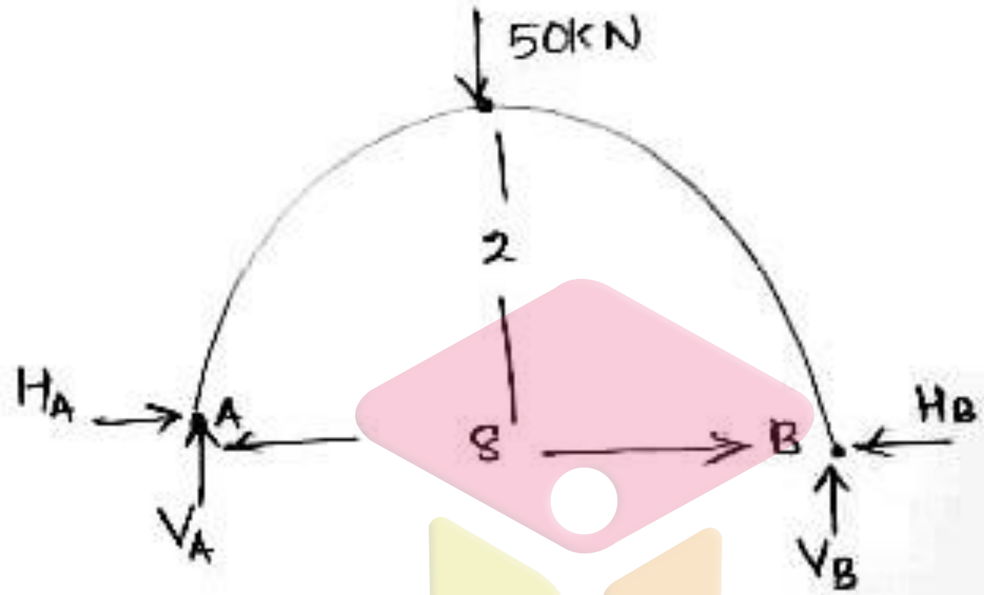
44. A three hinged parabolic arch of span 8 m and rise 2 m has a concentrated Load of 50 KN at the crown. The arch will be subjected to a horizontal thrust equal to

A. 25 kN

B. 100 kN

C. 0 kN

D. 50 KN



$$V_A = V_B = 25\,kN$$

$$V_A \times 4 - H_A \times 2 = 0$$

$$H_A = \frac{V_A \times 4}{2} = \frac{25 \times 4}{2} = 50\,kN$$

45. Flexibility method is also called

(1) Force method

(2) Compatability method

(3) Equilibrium method

(4) Displacement method

A. All are correct

B. 1 and 2 are correct

C. 2 and 3 are correct

D. 1 and 3 are correct

46. The number of plastic hinges required to convert a fixed beam into a mechanism is

A. 4

B. 3

C. 2

D. 1

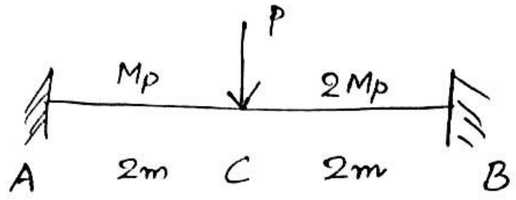
47. A fixed beam AB of span 4 m, is subjected to a concentrated load 'P' at C such that AC = CB. If AC and BC has plastic moment capacities of M_p and $2M_p$ respectively, the collapse load is:

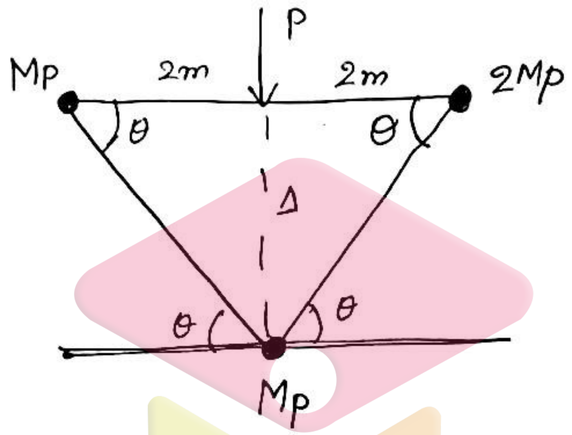
A. $4M_p$

B. $3.5\ M_p$

C. $2.5\ M_p$

D. $3M_p$





$W_e = W_i$

$P \times \Delta = Mp \times \theta$

$P \times 2\theta = Mp\theta + Mp\theta + Mp\theta + 2Mp\theta$

$P \times 2\theta = 5\,Mp\,\theta$

$P = \frac{5}{2} Mp$

$= 2.5\,Mp$

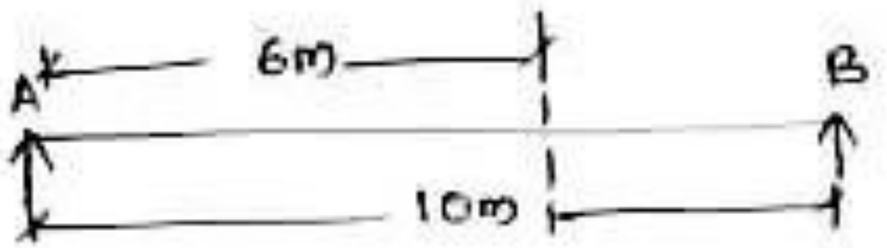
48. A moving load of 200 kN passes from support A to B in a simply supported beam AB of span 10m. What is the maximum bending moment developed at a section taken at 6m from A?

A. 480 kNm

B. 240 kNm

C. 360 kNm

D. 180 kNm



$$BM_{max} = w\,3\left(1 - 3/L\right)$$

$$= 200 \times 6\left(1 - \frac{6}{10}\right)$$

$$= 6 \times 0.4 \times 200$$

$$= 480\ kNm$$

49. Maximum number of 20 mm diameter bolts that can be accommodated in 200 mm wide flat is

A. 500

B. 4

C. 3

D. 2

$$2xe + (n-1)p = 200$$

$$e = 1.5d'$$

$$p = 2.5d$$

$$d = 20\,mm$$

$$d' = d + 2 = 20 + 2 = 22\,mm$$

$$e = 1.5 \times 22 = 33$$

$$p = 2.5 \times 20 = 50$$

$\therefore$ $$2 \times 33 + (n-1) \times 50 = 200$$

$$66 + (n-1)\,50 = 200$$

$$n - 1 = 2.68$$

$$n = 3.68 \approx \underline{4}.$$

50. Prying force is developed in bolted connections due to:

A. Bending

B. Compression

C. Shear

D. Tension

51. Loss of pre stress is not directly related to:

A. Creep of concrete

B. Shrinkage of concrete

C. Grade of concrete

D. Slipping of tendons from concrete

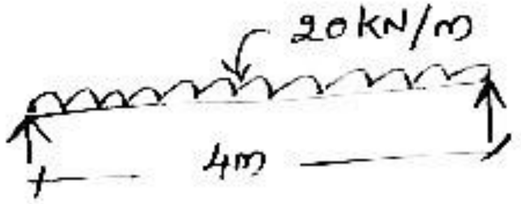
52.A simply supported beam of span 4 m is subjected to an uniformly distributed load of 20 kN/m inclusive of self-weight. If the Limiting moment of resistance of the beam cross section is 40 kNm, the beam is to be designed as:

A. Over reinforced

B. Under reinforced

C. Balanced

D. Doubly reinforced



$$M = \frac{wl^2}{8} = \frac{20 \times 4^2}{8} = \frac{20 \times 4 \times 4}{8_2}$$

$$= 40\ kNm$$

Given, $M_{u\,limit} = 40\ kNm$

Hence $M_u = M_{u\,limit}$

$\therefore$ It is Balanced section

53. The plastic moment capacity of rectangular section 255 kNm. The yield moment of the section in kNm is:

A. 170

B. 150

C. 160

D. 200

54. A single bay single storey portal frame is subjected to two point loads at one third span and midspan in the beam and a horizontal Load at beam level. The total number of possible mechanisms is:

A. 2

B. 3

C. 4

D. 5

55. Which one of the following is the correct statement about R.C. retaining wall:

A. Toe slab and heel slab are provided with reinforcements at top face

B. Toe slab and heel slab are provided with reinforcement at bottom face

C. Toe slab is provided with reinforcement at bottom face and heel slab at top face

D. Toe slab is provided with reinforcement at top face and heel slab at bottom face

56. The discharge q over a weir per unit length depends upon the head h of water over the weir, the height H of the weir and the acceleration due to gravity. Consider the following statements with respect to forming dimensionless constants:

(I) The number of dimensionless variables are 5

(II) The number of variables are 4

(III) The number of fundamental units are 3

(IV) The number of fundamental units are 2

(V) The number of r terms are 3

(VI) The number of x terms are 2

Choose the right combination of the statements from the options given below

A. I, III and V

B. 1.IV and VI

C. II, IV and VI

D. II, III and V

57.Group-1 contains dimensionless parameters and Group II contains areas of significance for dynamic similarity

Group-I	Group II
(K) Freud's Number	(1) Flow over spillways
(L) Reynold's Number	(2) Flow around submerged bodies
(M) Euler's Number	(3) Capillary movement of water through soils
(N) Weber Number	(4) Discharge through sluices

Choose the correct matching out of the following combinations

Codes:

	K	L	M	N
A.	1	2	3	4
B.	1	2	4	3
C.	2	1	3	4
D.	4	3	1	2

58.The weight density of honey is 12kN/m^3 and its dynamic viscosity at 20°C is 0.50 kg/m.s Neglecting the weight density of air, the velocity with which air bubble of 1.0mm diameter will rise in honey at 20°C is

A. 1.33 m/s

B. 1.33 mm/s

C. 0.70 mm/s

D. 0.70 m/s

$$V_T = \frac{2r^2 (S-g)}{9\mu}$$

$$= \frac{2}{9} \frac{D^2}{4\mu} \cdot Sp.wt$$

$$= \frac{D^2}{18} \times \frac{wt.density\ of\ liquid}{\mu\ liquid}$$

$$= \frac{1 \times 10^{-6}}{18} \times \frac{12 \times 10^{3}}{0.5}$$

$$= \frac{24}{18} \times 10^{-3}$$

$$= \frac{4}{3} \times 10^{-3}\ m/s$$

$$= \underline{1.33\ mm/s}$$

59.Out of the following options given below, choose the wrong one with respect to the boundary layer thickness :

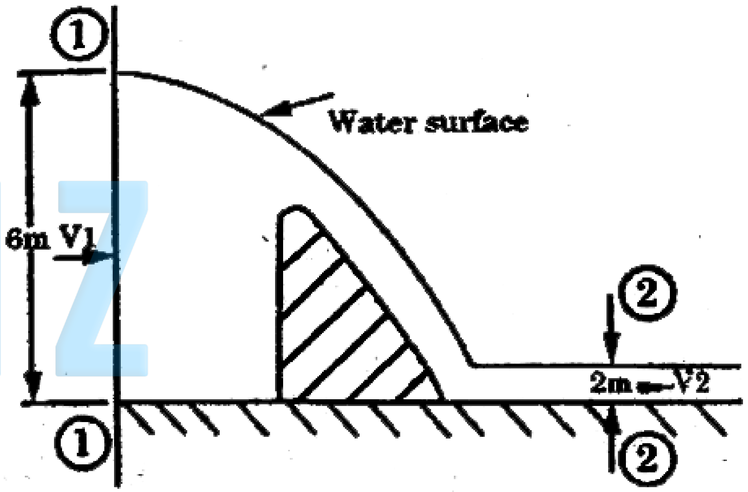
A. Increases in the direction of flow

B. Decreases as approach velocity increases

C. Increases as kinematic viscosity increases

D. Not dependent upon the pressure gradient in the direction of flow

60. Water flows over an obstruction and then flows along a downstream channel as shown in figure given below. The width of the flow is same on both sides of the obstruction. The depth of Dow at section 2-2 is 2m. Assuming that there is no energy loss between sections 1-1 and 2-2 and g = 10m/s^2, the velocity of flow at section 1-1 is:



A. $\sqrt{10}$ m/s

B. $3\sqrt{10}m/s$

C. $\sqrt{5}$ m/s

D. $3\sqrt{5}$ m/s

Specific Energy same,

$\therefore \quad E_1 = E_2$

$$y_1 + \frac{V_1^2}{2g} = y_2 + \frac{V_2^2}{2g}$$

$$6 + \frac{V_1^2}{2g} = 2 + \frac{V_2^2}{2g}$$

$$4 = \frac{V_2^2 - V_1^2}{2g}$$

$$V_2^2 - V_1^2 = 80$$

As per continuity equation,

$$A_1 V_1 = A_2 V_2$$

$$b y_1 V_1 = b y_2 V_2$$

$$6 V_1 = 2 V_2$$

$$V_2 = 3 V_1$$

$$9 V_1^2 - V_1^2 = 80$$

$$V_1^2 = 10$$

$$V_1 = \sqrt{10}$$

61. List-1 contains various irrigation efficiencies and List-II contains the procedure to calculate it

List-1	List-II
(K)Water conveyance efficiency	1) Ratio of the quantity of water delivered into the fields from the outlet point of the channel to the water entering in to the channel at its starting point.
(L) Water application efficiency	(2) Ratio of the water beneficially used to the quantity of water delivered.
(M) Water storage efficiency	(3) Ratio of the water stored in the root zone during irrigation to the water needed in the root zone prior to irrigation.
(N)Water use efficiency	(4) Ratio of the quantity of water stored into the root zone of the crops to the quantity of water actually delivered into the field.

Choose the correct matching between List-I and List-11 from the following options

Codes:

	K	L	M	N
A.	1	2	3	4
B.	1	3	4	2
C.	1	4	3	2
D.	4	3	1	2

62. Wheat is to be grown in a field having field capacity equal to 30% and the permanent wilting paint equal to 10%. Irrigation water is to be supplied when the moisture content of the soil falls to 20%. The root zone depth is I m, dry weight of soil is 14kN/m^3 and the specific weight of water is 10 kN/m^3. The Net Irrigation Requirement (NIR) for the above cultivation is:

A. 28 cm of water

B. 21cm of water

C. 19.6 cm of water

D. 14 cm of water

63. List-1 gives the names for geological formations with respect to its ground water Potentiality. List-II contains examples for the types given in List-I.

List-I:	List-II
(K)Aquifer	(1) Gravel deposits
(L) Aquitard	(2) Clay deposits
(M) Aquifuge	(3) Granite rocks
(N) Aquiclude	(4) Clay formations inter bedded with sand layers

Choose the correct matching of List-1 with List-II from the following options

Codes:

	K	L	M	N
A.	1	2	3	4
B.	1	4	3	2
C.	4	3	2	1
D.	2	4	1	3

64. Full Reservoir Level (FRL)

A. The maximum elevation to which reservoir water surface will rise during normal operating condition

B. The maximum level to which reservoir water will rise during worst design flood

C. The normal operating level in a reservoir

D. Both (B) and (C)

65. The following statements are connected with the seepage of water through earthen dams

Choose the false statement from the given

A. The hydrostatic pressure on the phreatic line is equal to zero

B. The flow of water below the phreatic line reduces the weight of the soil

C. The phreatic line represents the top stream line

D. The soil within the capillary fringe experiences reduction in shear strength

66. Among the arch dams given below, choose the one which consume least quantity of concrete

A. Constant radius arch dam

B. Constant angle arch dam

C. Shell arch dam

D. Variable radius arch dam

67. The following statements are with respect to the canal falls, choose the wrong statement:

A. In Sarda fall, for discharges above 14 Cumecs, trapezoidal crest having upstream side slope of 1 : 8 is provided

B. In Ogee falls there is heavy draw down on the upstream side

C. A trapezoidal notch fall provides a proportionate fall

D. Well type falls are suitable for high drops and very low discharges

68. Consider the following statements made with respect to the design of bottom floor Syphon Aqueduct :

I. Uplift due to water table occurs when the bottom slab is not depressed below drainage bed

II. The maximum uplift due to water table occurs when there is no water flowing over the canal

III. The maximum uplift due to water table occurs when water table reaches up to drainage bed level

IV. Maximum uplift due to seepage of water from the canal occurs when both canal and drain are running full

Choose the correct Statement combination from the options given below

A. I, III and IV

B. II, III and IV

C. IV only

D. III only

69. From the statements given below, choose the wrong one with respect to Lacey's regime channels

A. Regime theory is not applicable to channels in initial regime

B. Regime theory is applicable to channels which are either in true regime or in final regime

C. Coarser the silt, more nearly the section attains a semi circle

D. Channels flowing through the alluvium has the tendency to assume a semi elliptical section

70. A silty soul is having specific gravity (G) equal to 2.60 and porosity equal to 50%. The void ratio for the soil is 1.00 and bulk density is 14kN/m^3. The critical exit gradient for the soil is:

A. 0.00

B. 0.80

C. 240

D. 3.20

$$\rho_c = \frac{G-1}{1+e}$$

$e = 1$

$$= \frac{2.6-1}{1+1}$$

$$= \frac{1.6}{2} = 0.8$$

71. The rate of change of centrifugal acceleration for the design speed of 78 kmph in designing transition curve is:

A. 0.504

B. 0.490

C. 0.495

D. 0.510

$$\frac{80}{75+V} = \frac{80}{75+78} = 0.523$$

72. If ruling gradient is 1 in 25 and there is also a horizontal curve of radius 100 m, then compensated grade should be:

A. 3.00%

B. 3.05%

C. 3.90%

D. 3.25%

$$G.C = \left.\begin{matrix} \dfrac{30+R}{R} \\ \\ \dfrac{75}{R} \end{matrix}\right\} \text{least value}$$

$$G.C = \frac{75}{R} = 0.75$$

$$C.G = \frac{100}{25} - 0.75$$

$$= 3.25$$

73. If the tyre pressure is 0.56 and Mpa and wheel load is 40 kN then the radius of tyre contact area is

A. 20.04 cm

B. 15.07 cm

C. 16.07 cm

D. 16.00 cm

$$\text{Tyre pressure} = \frac{\text{Wheel load}}{\pi r^2}$$

$$r = \sqrt{\frac{40 \times 10^3}{0.56 \times \pi}}$$

$$= 150.7\,mm$$

$$= 15.07\,cm$$

74. Mixer of coarser filler material with bitumen to remove any internal voids is called as:

A. Modified bitumen

B. Modified asphalt

C. Mastic asphalt

D. Straight-run bitumen

75. The saturation flow in a traffic signal for a width of 4.5 to 5.0 m is normally

A. 2250 PCU/Hour
B. 1950 PCU/Hour
C. 2900 PCU/Hour
D. 1890 PCU/Hour

3. Determination of Saturation Flow

$$s = 525\ w$$

- s = saturation flow (PCU/hour)
- w = width of approach road (metres)

- The above formula is valid for widths from 5.5 to 18m.

Width w in metres	3.0	3.5	4.0	4.5	5.0	5.5
s (PCU/hour)	1850	1890	1950	2250	2250	2900

76. Shape of rotary type intersection which is suited for roads of equal importance carrying equal volumes intersect at equal angles is :

A. Squarish

B. Elliptical

C. Irregular

D. Circular

77. If the proposed airport elevation is 400 m and length of runway is 1260 m then the correction for elevation as pre standard is :

A. 1290 m

B. 1300 m

C. 1378 m

D. 1360 m

Altitude correction

Increase in runway length by 7%

for every 300m rise above MSL

$\therefore$ % correction required $= \frac{7}{300} \times 400\%$

$$\text{Correction} = 1260 \times \frac{7}{300} \times \frac{400}{100}$$

$$= 117.6 \text{ m}$$

$$\text{Corrected length} = 1260 + 117.6$$

$$= 1378 \text{ m}$$

78. The reduction of runway length both in landing and takeoff due to head wind component is around :

A. 15%

B. 10%

C. 0.70%

D. 12 %

79. If the permissible speed is 80 km.p.h. with a cant of 10 cm then the length of the transition curve on a B.G. line is :

A. 72 m

B. 44 m

C. 58 m

D. 60 m

$$L = 0.073 \times Cd \times V_{max}$$

$$= 0.073 \times 10 \times 80$$

$$= 58.4\ m$$

80. This sort of points and crossings are not recommended for main lines or heavy fast moving rail traffic lines :

A. Tandems

B. Slips

C. Three throws

D. Gauntlet track

81. These signals are provided to furnish special information to the drivers of train are called:

A. Co-acting signal

B. Indicator signal

C. Calling-on signal

D. Routing signal

82. Prevent the segment getting twisted out of the line braces are introduced at each joint of the arch segment in tunnel lining is called as

A. Wall plate

B. Laggings

C. Collar braces

D. Posts

83. Tunnelling method especially useful over soft strata/water bearing ground is known as :

A. Plenum

B. Steering method

C. Primary lining

D. Ground pressure

84. The average height of the waves that are observed over a period, considering the highest one third of the waves in a group of waves is called as :

A. High storm wave

B. Significant wave

C. Low storm wave

D. Average wave

85. This force reduces the apparent weight and hence, the marine structures suffer these losses to a great extent unless the foundations are absolutely impervious is known as :

A. External forces

B. Solvent actions of sea water

C. Sea insects

D. Hydrostatic forces

86. The total water consumption per capita demand (q) including domestic, industrial, commercial and civic or public use for an average Indian city, as per IS code may be taken as :

A. 135 *l*/c/d

B. 210 *l*/c/d

C. 240 *l*/c/d

D. 280 *l*/c/d

87. Wholesome water is the one which does not contain :

A. Pathogenic bacteria

B. Suspended matter in quantities harmful to man

C. Dissolved matter in quantities harmful to man

D. All of the above

88. The desirable limit of chlorides in drinking water as per BIS (IS 10500:1991) is :

A. 0.5 mg/*l*

B. 2.5 mg/*l*

C. 250 mg/*l*

D. 100 mg/*l*

89. Detention Time for a sedimentation tank of a rectangular type (continuous flow rate) is given for a tank, passing a discharge = Q. and have length = L, Width = B and Depth = H, as :

A. BLH/Q

B. Q/BLH

C. Q/BL

D. BL/Q

90. Clariflocculator is a :

A. Plain sedimentation plant

B. Aeration plant

C. Coagulation and sedimentation plant

D. None of the above

91. Which of the following chemical compound can be used for dechlorination of water

A. Carbon dioxide

B. Bleaching powder

C. Sulphur dioxide

D. Chloramines

92. A suitable layout for a water supply distribution system for a city of having a system of radial roads emerging from different centres, is :

A. Dead end system

B. Grid Iron system

C. Ring system

D. Radial system

93. The self-cleansing velocity (V_s) is given as :

A. $V_s = \sqrt{kd'(G-1)}$

B. $V_s = c.\sqrt{kd'(G-1)}$

C. $V_s = d'.\sqrt{kc'(G-1)}$

D. $V_s = k.\sqrt{cd'(G-1)}$

94. Hydraulic mean depth of a circular sewer while running partially full is

A. $\frac{D}{4}\left(1-\frac{360^o\ sin\propto}{2\Pi\propto}\right)$

B. $\frac{D}{8}\left(1-\frac{360^o\ cos\propto}{2\Pi\propto}\right)$

C. $\frac{D}{4}\left(1-\frac{360^o cos\propto}{2\Pi\propto}\right)$

D. $\frac{D}{4}\left(1-\frac{360^o tan\propto}{2\Pi\propto}\right)$

95. The BOD rate constant (K_D) at the given temperature is :

A. $0.435\ K_D$

B. $0.431\ K_t$

C. $0.434\ K$

D. $0.343\ K$

96. Relative Stability (S) of a treated sewage effluent is :

A. $S = 100\,[1-(6.30)^{t(37)}]$

B. $S = 100\,[1-(0.630)^{t(20)}]$

C. $S = 100\,[1-(0.0630)^{t(37)}]$

D. $S = 100\,[1-(0.630)^{t(37)}]$

97. The mathematical form of Streeter-Phelps equation is

A. $D_t = \frac{K_D.L}{K_R - K_D}[(10)^{-K_D.t} - (10)^{-K_R.t}]$

B. $D_t = \frac{K_D.L}{K_R - K_D}[(10)^{-K_D.t} - (10)^{-K_R.t}] + [D_0 \times (10)^{-K_R.t}]$

C. $D_t = \frac{K_R.K_D}{K_D.L}[(10)^{-K_D.t} - (10)^{-K_R.t}]$

D. $D_t = \frac{K_R - K_D}{K_D.L}[D_0 \times (10)^{-K_D.t}]$

98. The strokes equation for viscous flow and small sized particles, represented by R_e <0.5 is:

A. $\upsilon_s = \frac{g}{18}(G-1)\frac{\upsilon}{d^2}$

B. $\upsilon_s = \frac{g}{18}(G-1)\frac{\upsilon^2}{d^2}$

C. $\upsilon_s = \frac{g}{18}(G-1)\frac{\upsilon^2}{d}$

D. $\upsilon_s = \frac{g}{18}(G-1)\frac{d^2}{\upsilon}$

99. F/M ratio is:

A. $\frac{F}{M} = \frac{Q.Yo}{V.Xt}$

B. $\frac{F}{M} = \frac{Q}{Xt}$

C. $\frac{F}{M} = \frac{Y_o}{V}$

D. $\frac{F}{M} = \frac{Q}{V}$

100. Slude Volume Index (SVI) is:

A. $SVI = \frac{V_{ob}}{X_{ob}}$

B. $SVI = \frac{X_{ob}}{V_{ob}}$

C. $SVI = \frac{V_{ob}}{X_{ob}} \times 1000$

D. $SVI = \frac{X_{ob}}{V_{ob}} \times 1000$