CIVIL ENGINEERING

1. Consider the following statements:
   1. Coarse-grained soils having fines (<75 μ in size) between 5% and 15% have a dual symbol according to IS Code for soil classification.
   2. At liquid limit, all soils have the same shearing strength
   3. Lower the shrinkage limit, greater is the volume change in a soil with change in water content.

   Of these statements
   a. 1 and 2 are correct
   b. 1 and 3 are correct
   c. 2 and 3 are correct
   d. 1, 2 and 3 are correct

2. Which of the following have an influence on the value of permeability?
   1. Void ratio
   2. Degree of saturation
   3. Pressure head
   4. Grain size

   Select the correct answer using the codes given below
   a. 1,2 and 4
   b. 1,2 and 3
   c. 2,3 and 4
   d. 1,3 and 4

3. Match List I with List II and select the correct answer:

   List I
   A. Optimum
   B. moisture content
   C. Vibratory rollers
   D. Zero air void line

   List II
   1. Compaction of cohesive soil
   2. Compaction of granular soil
   3. Maximum dry density
   4. Relative density
   5. 100% saturation

	A	B	C
a.	4	1	3
b.	3	2	5
c.	4	1	5
d.	3	2	4

4. A 1.2 m layer of soil is subjected to an upward seepage head of 1.8 m. A layer of coarse sand is laid above the soil layer to attain a factor of safety of 2 against piping. Both the soil and coarse sand have the same values of G = 2.7 and e = 0.67. There is negligible head loss in the sand layer. The required depth of the coarse sand layer is
   a. 0.9 m
   b. 1.2 m
   c. 2.4 m
   d. 3.6 m

5. Consider the following statements regarding flownet representing flow through a soil below a concrete dam:
   1. The flownet will not alter if the level of reservoir is raised
   2. The flownet will not alter if the soil medium is altered.
   3. The flownet would not alter if the upstream and downstream water levels were to be interchanged

   Of these statements
   a. 1 and 2 are correct
   b. 1 and 3 are correct
   c. 2 and 3 are correct
   d. 1,2 and 3 are correct

6. In a flownet diagram, the length of the flow line in the last square is 2m, the total head loss is 18m and the number of potential drops is 12.

   The value of exit gradient is
   a. 0.33
   b. 0.75
   c. 1.33
   d. 3.00

7. A soil sample has 28g of soil solids, 10 cu cm of voids 9g of water and specific

gravity of soil grains of 2.7: consider the following statements in this regard:

1. The water content is $9/28\times100\%$
2. The void ratio is $\frac{10\times2.7}{28}$
3. Degree of saturation is $\frac{9}{10\times2.7}\times100$
4. The porosity is $\frac{10\times2.7}{(28+10\times2.7)}$

Of these statements

a. 1, 2 and 3 are correct
b. 2, 3 and 4 are correct
c. 1, 3 and 4 are correct
d. 1, 2 and 4 are correct

8. Given that for a sand sample

critical void ratio = 0.50 initial void ratio = 0.60

If the sand sample is subjected to continued shear, its volume will

a. Increase
b. Decrease
c. Not change
d. Initially increase and then decrease

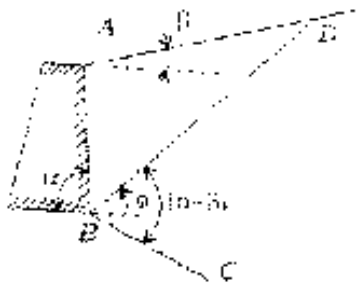
9 A clear dry sand sample is tested in a direct shear test. The normal stress and the shear stress at failure are both equal to 12 kN/m^2. The angle of shearing resistance of the sand will be

a. 25
b. 35
c. 45
d. 55°

10 An initial cross sectional area of a clay sample was 15 sq cm. The failure strain was 25% in an unconfined compression test. The corrected area of the sample at failure would be

a. 15 sq cm
b. 20 sq cm
c. 25 sq cm
d. 30 sq cm

11



The given figure shows culmann's graphical construction for earth pressure. δ is the angle of wall friction. The earth pressure line is represented by

a. AB
b. BC
c. BD
d. AD

12 A slope is to be constructed at an angle of 30° to the horizontal from a soil having the properties C = 15kN/m², $\phi = 22.5°$, $\gamma = 19kN/m^3$. Taylor's stability number is 0.046. if a factor of safety (with respect to cohesion) of 1.5 is required, then the safe height of the slope will be

a. 25.8 m
b. 19.1 m
c. 17.2 m
d. 11.5 m

13 Consider the following statements regarding the principle of effective stress:

1. Contact stress between soil grains is called the effective stress.
2. It is not possible to physically measure the effective stress
3. The equation $\sigma = \sigma' - u$ is not strictly applicable to a partially saturated soil

Of these statements

a. 2 and 3 are correct
b. 1 and 2 are correct
c. 1 and 3 are correct
d. 1, 2 and 3 are correct

14 When the primary consolidation process in a soil is complete then

a. The hydrostatic pressure will become zero
b. The excess pore water pressure will become zero

c. Both the hydrostatic and excess pore water pressure will become zero

d The effective stress will become zero

15 15. Under a given load, a clay layer attains 30% degree of consolidation in 100 days. The time taken by the same clay layer to attain 60% degree of consolidation will be

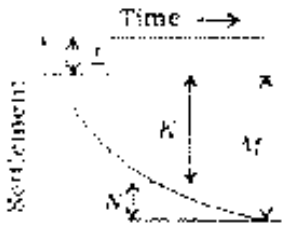
a. 1600 days

b. 800 days

c. 400 days

d 200 days

16. Match List I with List II for the given diagram and select the correct answer using the codes given below:



List I (Type of settlement)

A. Immediate settlement

B. Primary consolidation

C. Secondary compression

D Time dependent settlement

List II (Notation on the diagram)

1 K

2. L

3. M

4. N

	A	B	C	D
a.	1	2	4	3
b.	2	1	4	3
c.	2	1	3	4
d	1	2	3	4

17. A 1m × 1m surface footing in a saturated clay soil with $\phi_u = 0^\circ$ has the ultimate bearing capacity 4q the ultimate bearing capacity of a surface footing of dimensions 3m × 3m on the same soil will be

a 4q/3

b. 4q

c $4q\cos(1/3)$

d. $4q\sin^{-1}(1/3)$

18 A 2m thick deposit of fill weighting 15 kN/m^3 is placed over a large area. According to new mark chart, the increase in vertical stress at 1m depth below the base of the fill is 30 kN/m^2

The increase in vertical stress at 2m depth will be

a. 30 kN/m^2

b. 15kN/m^2

c. 7 5kN/m^2

d 60 kN/m^2

19 Frication piles are most effective in

a. Soft clays

b. Dense sands

c. Organic soils

d. Filled up soils

20 A circular cross section is preferred for a well foundation mostly because

a. is most economical

b. The effort needed for sinking the well is the least

c Providing a well cap is easy

d. Oblong shaped wells are most difficult to construct

21 A fully compensated raft foundation for a building is

a Designed as a very rigid raft

b. Designed as a completely flexible raft

c Such that the weight of the excavated soil is equal to the load due to the building

d. Supported by piles of short length

22 For a damped vibrating system with single degree of freedom. resonance occurs at a frequency ratio of

a 1

b. 0

c Less than 1

d. Greater than 1

23 At a site having a deposit of dry sandy soil, an average soil of standard penetration resistance N equal to 6 was recorded. The compactness of the soil deposit can he described as

a Very loose

b. Dense

c Medium

d. Loose

24. The main plate of a transit is divided into 1080 equal divisions. 60 divisions of the vernier coincide exactly with 59 divisions of the main plate. The least count (in seconds) of the transit is

a. 5

b. 10

c. 15

d. 20

25. A lens or a combination of lenses in which no spherical aberration exists, is said to be

a. Achromatic

b. Ahallatic

c. Aplantic

d. Anastigmatic

26. The sides of a rectangle are (120 0.05 m) and (180 ± 0.06) m. The probable error in the area will be

a. ± 16.8 sq m

b. + 12.35 sq m

c. + 16.2 sq m

d. ± 11.55 sq m

27. The linear error in a 50 m long traverse is 0.01 m. The angular error (in seconds) considering equal precision will be

a. 81

b. 41

c. 21.5

d. Zero

28. A 30 m long steel tape standardized with a pull of 100 N was used for measuring a baseline of length 1500 m. The pull exerted while measuring is 150N The correction C due to pull is given by (the area of cross-section of the tape = A; Young's modulus = E)

a. $\frac{50 \times 1500}{AE}$

b. $\frac{1500 \times 150}{AE}$

c. $\frac{50 \times 1500}{AE}$

d. $\frac{250 \times 1500}{AE}$

29. Mean sea level of any place is the average datum of the hourly tide heights observed over a period of nearly

a. 5 years

b. 10 years

c. 20 years

d. 50 years

30. Excavation is to be made for a reservoir measuring 20 m long, 12 m wide at the bottom and 2 m deep. The side slopes are to be 1: 1 and the top to be flush with the ground which is level in the vicinity. As per prismoidal formula, the volume of excavation will be

a. 610.33 m^3

b. 618.66 m^3

c. 625.00 m^3

d. 632.66 m^3

31. Given that for a plant meter

L = length of the tracing arm

R = radius of the anchor arm

a = distance between the roller and hinge

If the wheel is beyond the hinge, then the area of zero circle will be

a. $\pi\left(L^2 + 2aL + R^2\right)$

b. $\pi\left(L^2 - 2aL + R^2\right)$

c. $\pi\left(L^2 - aL - R^2\right)$

d. $\pi\left(L^2 + aL + R^2\right)$

32. For a sight inclined at $\theta°$ with the horizontal and the staff held normal to the line of sight held normal to the line of sight. The staff intercept is S. the horizontal distance D between the tachometer attached with an analytic lens and the staff station will be equal to (other symbols have the usual meanings)

a. $kS\cos\theta + r\sin\theta$

b. $kS\sin\theta + r\cos\theta$

c. $(kS - c)\cos\theta + r\sin\theta$

d. $(kS - c)\sin\theta + r\cos\theta$

33. The errors in linear and angular measurements for a line of length l are respectively C_1 and C_2. the Bow ditch's principle of adjusting a traverse corresponds to

a. $C_1 \propto \frac{1}{\sqrt{I}}$ and $C_2 \propto \sqrt{I}$

b $C_1 \propto \sqrt{I}$ and $C_2 \propto \frac{1}{\sqrt{I}}$

c. $C_1 \propto \sqrt{I}$ and $C_2 \propto \sqrt{I}$

d. $C_1 \propto \frac{1}{\sqrt{I}}$ and $C_2 \propto \frac{1}{\sqrt{I}}$

34 Match List I with List II and select the correct answer:

List I (Names)

A Boning rod

B. Traveling rod

C. Sight rails

D. Batter boards

List II

1.

2.

3.

4.

5.

	A	B	C	D
a.	3	2	5	4
b.	5	4	1	3
c.	2	4	1	3
d.	2	3	1	4

35 Match list I (Elements of a simple circular curve) with List II (Dentitions) and select the correct answer:

List I

A. Vertex

B. Ling chord

C. Tangent distance

D External distance

List II

1 The line joining the point of curvature and point of Tangency

2. Back tangent and forward tangent when extended intersect at this point

3. Distance between the mid-point of long chord and mid-point of the curve

4. Distance between point of tangency and the point of intersection

5. Distance between point of intersection and middle point of the curve

	A	B	C	D
a.	4	2	5	3
b.	3	2	4	5
c	2	1	4	5
d	2	1	5	3

36 Consider the following basic criteria of a transition curve:

1. Its curvature should be equal to the radius of the circular curve at its unction with the straight.

2. The rate of increase of curvature along the transition curve should be equal to the late of increase of super elevation.

3. It should be tangential to the straight line and meet the circular curve with the same radius as that of the circular curie

Of these statements

a 2 alone is correct

b. 1 and 3 are correct

c 2 and 3 are correct

d. 1, 2 and 3 are correct

37 It is proposed to insert a circular curve of radius 300 m with a cubic parabola of length 90 m at each end. The deflection angle between the straights is 40°. The shift of the curve is

a 1.125 m

b. 0.75 m

c 0.5625 m

d. 0.225 m

38 Given that for a triangulation survey

D = distance in km

H – the visible horizon from a station of known elevation above the datum (in metres)

If there is no obstruction due to intervening ground, then h is equal to

a. $0.6735\ D^2$

b. $6.735\ D^2$

c. $0.06735\ D^2$

d. $0.006735\ D^2$

39. For solving a right-angled astronomical triangle ZPS, right- angled at S, the parts of the Napier circle are to be filled up ing the following elements:

1. Complement of the angle SZP
2. Complement of the side ZP
3. The sides PS and ZS
4. Complement of the angle ZPS

The correct sequence of filling up these elements is:

a. 3,1,4,2

b. 3,1,2.4

c. 1,3,2.4

d. 1,3.4.2

40. Match List I with List II and select the correct answer:

List I

A. A. Star at elongation

B. Star at prime vertical

C. Star at horizon

D. Star at culmination

List II

1. The angle formed between the flight line and the edges of photography in the direction of flight
2. Failure of the aero plane to stay on the predetermined flight line.
3. The point where a perpendicular dropped from the front nodal point strikes the photograph.
4. The point at which the bisector of the angle of tilt meets the photographer.

	A	B	C	D
a.	4	1	2	3
b.	1	4	2	3
c.	4	1	3	2
d.	1	4	3	2

41. The latitude and longitude of point M is 30° N and 15° N the latitude and longitude of point N is 20° S and 25°E. MN will be given by

a. $\cos 60° \cos 70° + \sin 60° \sin 70° \cos 40°$

b. $-\cos 60° \cos 70° + \sin 60° \sin 70° \cos 40°$

c. $\cos 60° \cos 70° - \sin 60° \sin 70° \cos 40°$

d. $\cos 60° \cos 70° \sin 60° \cos 70° \cos 40°$

42. Match List I with List II with respect to Aerial photogrammetry and select the correct answer using the codes given below:

List I (Name)

A. Principal point

B. Is centre

C. Crab

D. Drift

List II (Explanation)

1. The angled formed between the flight line and the edges of photograph in the direction of flight.
2. Failure of the aero plane to stay on the predetermined flight line
3. The point where a perpendicular dropped from the front nodal point strikes the photograph.
4. The point at which the bisector of the angle of tilt meets the photographer.

	A	B	C	D
a.	4	3	2	1
b.	4	3	1	2
c.	3	4	1	2
d.	3	4	2	1

43. Given that:

Scale of the photograph 50 m = 1 cm

size of photograph = 18 cm × 18 cm

percentage longitudinal overlap = 60

percentage side overlap = $33\frac{1}{3}$ the

covered area 108 sq km

the required number of photographers will be

a. 200

b. 400

c. 500

d. 600

44. Air base B, photographic base b, flying height H and the focal length f of a vertical photograph are related as

a. $B = \frac{bf}{H}$

b. $B = \frac{bH}{f}$

c. $B = b\left(1 + \frac{H}{f}\right)$

d. $B = b\left(1 - \frac{H}{f}\right)$

45. Images of two objects on a pair of photographs have a parallax difference of 1.8 mm and an average photograph base of 88.2 m. The flying height is 4000 m above the average ground level. The difference in elevation of the two objects would be

a. 40 m

b. 60 m

c. 80 m

d. 90 m

46. The given table shows the bearings observed while traversing with a compass:

Line	FB	BB
AB	45°45'	226°10'
BC	96°55'	277°5'
CD	29°45'	209°10'
DA	324°48'	144°8'

B and C D and A

Which one of the following pairs of stations is affected by local attraction?

a. A and B

b. B and C

c. C and D

d. D and A

47. Consider the following fluids:

1. Blood
2. Glycerine
3. Molasses
4. Slurry of clay in water
5. Kerosene

Among these non-Newtonian fluids would include:

a. 2,4 and 5

b. 2,3 and 4

c. 1,3 and 4

d. 1,4 and 5

48. Match List I (Units) with List II (Dimensions) and select the correct answer:

List I

A. Pressure Intensity

B. Horse Power

C. Reynolds Number

D. Specific Weight

List II

1. $M^0L^0T^0$
2. $ML^{-2}T^{-2}$
3. ML^2T^{-3}
4. $ML^{-1}T^{-2}$

	A	B	C	D
a.	3	4	2	1
b.	4	3	2	1
c.	4	3	1	2
d.	3	4	1	2

49. The dynamic viscosity of a fluid is 0.5 poise and its specific gravity is 0.5. The kinematics viscosity of this fluid (in stokes) is

a. 0.25

b. 0.5

c. 1.0

d. 1.5

50. Match List I with List II and select the correct answer:

List I (Fluid property)

A. Compressibility

B. Gravity

C. Viscosity

D. Vapour pressure

List II (Flow phenomenon)

1. Flow of real fluid past a tiny sphere
2. Cavitations
3. Hydraulic jump
4. Flight of supersonic aircraft

	A	B	C	D
a.	4	3	2	1
b.	4	3	1	2
c.	3	4	1	2

d 3 4 2 1

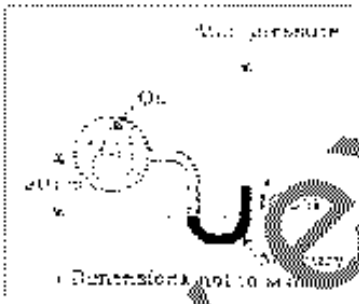
51. Consider the following statements:

1. The centre of pressure is always above the centroid of any plane submerged surface that is not horizontal
2. The total force acting on a submerged plane surface is the product of the area of the surface and the pressure at the centroid of the plane surface.
3. The horizontal component of the resultant force on a curved surface is calculated by horizontally projecting the surface onto a horizontal plane and treating the projected area as a submerged horizontal plane surface.
4. The vertical component of force on a curved surface is obtained by calculating the weight of the liquid above and below the surface.

Of these statements

a. 1 alone is correct
b. 2 alone is correct
c. 2 and 3 are correct
d. 1 and 4 are correct

52



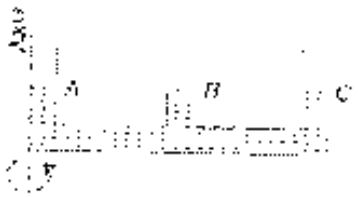
A U-tube manometer is used to measure the pressure in an oil pipe A as shown in the figure. The specific gravity of the oil is 0.8 and that of mercury is 13.6. The equivalent gauge pressure is nearly

a. 7.53 kN/m^2
b. 11.76 kN/m^2
c. 13.34 kN/m^2
d. 15.00 kN/m^2

53. A racing car with a partially filled fuel tank moves in the horizontal direction at a uniform acceleration equal to g. The free surface of the liquid fuel in the tank will assume a slope of

a. 20°
b. 34°
c. 45°
d. 60°

54



A multi—tube manometer filled with water up to level A,B and C as shown in the figure is rotated about the vertical axis at A. The water levels at A,B and C will all lie on

a. A circle
b. An ellipse
c. A hyperbola
d. A parabola

55 A circular plate of diameter d is submerged in water vertically, so that the topmost point is just at the water surface. The centre of pressure on the plate will be below the water surface at a depth of

a 5d/8
b. 11d/16
c. 2d/3
d. 3d/4

56 When a ship moving on seawater enters a river and moves inland, it is expected to

a Rise a little
b Sink a little
c. Maintain the same level of draft
d. Rise or fall depending on whether it is made of wood or steel

57 Match List I with List II and select the correct answer:

List I

A Submerged body
B. Floating body
C. Met centric height
D Buoyancy

List II

1. Force on a curved surface
2. Moment of inertia
3. Met centre
4 Force acting vertically up

5. Centre of buoyancy

	A	B	C	D
a.	5	3	2	1
b.	1	2	3	4
c.	5	3	2	4
d.	1	2	5	4

58. Which one of the following represents two-dimensional rotational flow?

a. $u = y; v = -y$

b. $u = 3x^2 - 3y^2; v = -6xy$

c. $u = y; v = x$

d. $u = x^2 y; v = -xy^2$

59. Which one of the following pairs is NOT correctly matched?

a. Energy equation : Flow through a venture meter

b. Cavitations : Force exerted in a pipe bend

c. Flow net : Flow through porous media

d. Free vortex : Flow of water in a wash basin

60. The velocity components in a 2-D flow an incompressible fluid are given by the equations

$u = 2xy; v = a^2 + x^2 - y^2$

The flow

a. Satisfies irrotationality condition and the continuity equation

b. Satisfies irrotationality condition but not the continuity equation

c. Does not satisfy the irrotationality condition but satisfies the continuity equation

d. Does not satisfy either the irrotationality condition or the continuity equation

61. Match List I with List II and select the correct answer:

List I (Phenomenon)

A. Rotational flow

B. Irrigational flow

C. Singularities

D. Streamline spacing

List II (condition)

1. Velocity zero or infinite
2. Proportional to velocity
3. Vorticity is zero
4. Vorticity exists

	A	B	C	D
a.	3	4	1	2
b.	4	3	1	2
c.	4	3	2	1
d.	3	4	2	1

62. Match List I with List II and select the correct answer:

List I (Object in a fluid)

A. Submarine

B. Parachute

C. Aircraft wing (airfoil)

D. Smoke stack (chimney)

List II (drag coefficient)

1. 1.33
2. 1.10
3. 0.15
4. 1.00

	A	B	C	D
a.	1	3	2	4
b.	3	1	4	2
c.	1	3	4	2
d.	3	1	2	4

63. Which one of the following statements on similitude is correct?

a. To achieve dynamic similarity between the model and the prototype, there need not be any geometric similarity

b. For kinematics similarity between the model and the prototype, the ratios of forces between the model and the prototype should be the same

c. For dynamic similarity between model and prototype in a compressible flow system, the Weber numbers must be the same

d. For dynamic similarity between the model and the prototype, the ratio of forces must be the same

64. Consider the following conditions:

1. Fluid is ideal.
2. Flow is steady
3. Fluid is laminar.

4. Fluid is Newtonian and flow is turbulent.
5. Flow is along a streamline.

For $\frac{P}{\gamma}+z+\frac{V^2}{2g}=$ constant, the conditions to be stratified are

a. 1, 2 and 5
b. 2, 3 and 4
c. 1, 3 and 4
d. 2, 3 and 5

65. The limit of the values of the coefficient of discharge of venture meter is between
a. 0.60 to 0.75
b. 0.76 to 0.80
c. 0.81 to 0.94
d. 0.95 to 0.99

66. Match List I with List II and select the correct answer:

List I

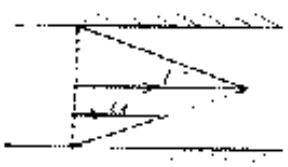
A. Moment of momentum equation
B. Bernoulli's equation
C. Euler's equation
D. Hagen-Poiseuille equation

List II

1. Equation to find energy loss in pipeline having laminar flow
2. Equation of motion for one-dimensional steady flow of ideal and incompressible fluid
3. Equation based on conservation of momentum principle applicable to circulatory flows
4. Three dimensional equation of motion based on principle of conservation of momentum for ideal and incompressible fluid flow

	A	B	C	D
a.	2	3	4	1
b.	3	2	1	4
c.	2	3	1	4
d.	3	2	4	1

67.



The momentum correction factor β for triangular velocity distribution (or flow between parallel plates as shown in the figure is

a. 2.00
b. 1.50
c. 1.33
d. 1.00

68. Which one of the following pair is correctly matched?
a. Prandtl : Flow through channels
b. Continuity equation : Law of conservation of energy
c. Mixing length : Laminar flow
d. Karman vortex street : Flow past a cylinder

69. A Pitot tube (coefficient = 1.0) is used to measure the velocity of air of mass density 1.2 kg/m³. If the head difference in a manometer tube filled with water is 12 mm, then the velocity of air (in m/s) will be
a. 10
b. 14
c. 17
d. 20

70. Match List I with List II for different stages of flow in a pipeline and select the correct answer:

List I

A. Laminar flow
B. Smooth turbulent flow ($Re = 10^5$)
C. Rough turbulent flow
D. Smooth turbulent flow ($Re = 10^7$)

List II

1. $f=\frac{0.3164}{(Re)^{1/4}}$
2. $\frac{1}{\sqrt{f}}=-0.8+2\log\left(Re\sqrt{f}\right)$
3. $f=\frac{64}{Re}$
4. $\frac{1}{\sqrt{f}}=1.74-2\log\left(Re/k\right)$

	A	B	C	D
a.	3	1	4	2
b.	1	3	4	2

c. 3 1 2 4

d. 1 3 2 4

71. Which one of the following statements is NOT correct?

a. Change of flow properties across the surface of a shock wave is normally smooth and continuous

b. Normal shock waves are waves normal to the direction of flow

c. The shock is a very sudden change of fluid properties occurring in supersonic flow

d. The wave front produced by a needle point is always conical

72. Consider the following statements in relation to dimensionless numbers:

1. Inertia force is always involved in the expression of any dimensionless number.
2. Weber number is significant in a flow system where viscous force dominates.
3. Mach number is significant in a flow system where the flow is of compressible fluid.
4. Reynolds number is significant when both gravity force and viscous force predominate.

Of these statements

a. 1 and 2 are correct

b. 1 and 3 are correct

c. 2 and 4 are correct

d. 3 and 4 are correct

73. Separation of boundary layer takes place under

a. Positive pressure gradient in the direction of flow

b. Negative pressure gradient in the direction of flow

c. Zero pressure gradient in the direction of flow

d. Very rough surface

74. **Assertion (A):** Centroid of an area will lie on the axis of symmetry, if it exists.

Reason (R): Distance of centroid from any axis is given by moment of area divided by total area

a. Both A and R are true and R is the correct explanation of A

b. Both A and R are true but R is NOT the correct explanation of A

c. A is true but R is false

d. A is false but R is true

75. **Assertion (A):** The buckling load of columns is affected by the end conditions.

Reason (R): The buckling load can be increased by increasing the equivalent length of a column.

a. Both A and R are true and R is the correct explanation of A

b. Both A and R are true but R is NOT the correct explanation of A

c. A is true but R is false

d. A is false but R is true

76. **Assertion (A):** A two-hinged arch compared to a simply supported beam of identical span and vertical loading develops lesser bending moment.

Reason (R): The arch resists the load by vertical as well as horizontal components of support reactions.

a. Both A and R are true and R is the correct explanation of A

b. Both A and R are true but R is NOT the correct explanation of A

c. A is true but R is false

d. A is false but R is true

77. **Assertion (A):** The phenomenon of quick sand occurs mostly in coarse sands and gravels.

Reason (R): Quicksand condition does not occur in clay soils as their cohesion holds the grains together even under upward flow at critical hydraulic gradient.

a. Both A and R are true and R is the correct explanation of A

b. Both A and R are true but R is NOT the correct explanation of A

c. A is true but R is false

d. A is false but R is true

78. **Assertion (A) :** The load-carrying capacity of a bored cast in situ pile in a sand soil is much less than that of a driven pile of similar dimensions.

Reason (R): A driven pile generates much more point bearing resistance than a bored pile.

a. Both A and R are true and R is the correct explanation of A

b. Both A and R are true but R is NOT the correct explanation of A

c. A is true but R is false

d. A is false but R is true

79. **Assertion (A):** In dimensional analysis, dimensionless numbers can be expressed as ratios of forces acting on a system.

Reason (R): In dimensional analysis, Mach number is the ratio of inertia force to elastic force and may be expressed as $\frac{V}{\sqrt{E/\rho}}$ with usual notations.

a. Both A and R are true and R is the correct explanation of A

b. Both A and R are true but R is NOT the correct explanation of A

c. A is true but R is false

d. A is false but R is true

80. **Assertion (A):** The kinematics viscosity of both air and water decreases as the temperature increases.

Reason (R): The kinematics viscosity of liquids and gases at a given pressure is a function of temperature.

a. Both A and R are true and R is the correct explanation of A

b. Both A and R are true but R is NOT the correct explanation of A

c. A is true but R is false

d. A is false but R is true

81. **Assertion (A):** Energy is lost in a sudden contraction in a pipeline.

Reason (R): If the flow is now reversed, energy is gained at the transition which acts as an expansion.

a. Both A and R are true and R is the correct explanation of A

b. Both A and R are true but R is NOT the correct explanation of A

c. A is true but R is false

d. A is false but R is true

82. **Assertion (A):** Except in the case of an overhanging cliff, two contour lines cannot merge or intersect at a point on the map.

Reason (R): Intersection of two contour lines means one point on the surface of the earth will have two different elevations. This is not possible.

a. Both A and R are true and R is the correct explanation of A

b. Both A and R are true but R is NOT the correct explanation of A

c. A is true but R is false

d. A is false but R is true

83. **Assertion (A):** The degree of the curve is directly proportional to the radius of the curve.

Reason (R): A sharp curve has a large degree of curve and a flat curve has a small degree of curve.

a. Both A and R are true and R is the correct explanation of A

b. Both A and R are true but R is NOT the correct explanation of A

c. A is true but R is false

d. A is false but R is true

84. Two forces each equal to P act on a body. One force acts in north-east direction and the other in north-west direction. Their effect may be neutralized by a third force acting in south direction with its magnitude equal to

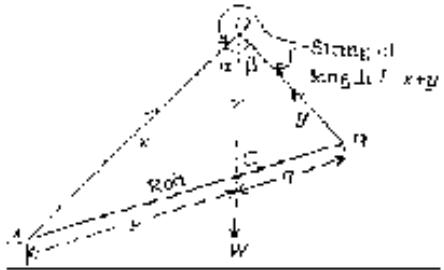
a. $P\sqrt{2}$

b. $\sqrt{2}P$

c. $P/\sqrt{2}$

d. 2P

85.



A rod AB of weight W is in equilibrium. Its centre of gravity divides it into two portions of lengths p and q. A string of length l is tied to its ends and the stringer is slung over a small smooth peg O such that $OA = x, OB = y$ and $x + y = l$ as shown in figure. The line of action (O) of W making angles α and β would be such that

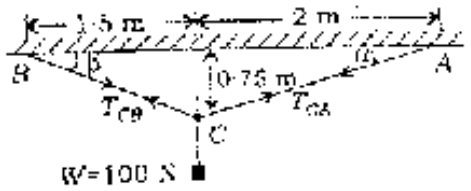
a. $\alpha > \beta$

b. $\alpha < \beta$

c. $\alpha = \beta$

d. The rod will not be in equilibrium as the peg is smooth

86.



A lamp of weight W = 100 N is supported by two cables CA and CB as shown in the figure. The equation for analyzing the cable system is given by

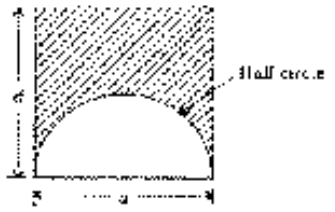
a. $T_{CA}\dfrac{2}{\sqrt{4.563}} + T_{CB}\dfrac{1.5}{\sqrt{2.813}} = 0$

b. $T_{CA}\sin\alpha + T_{CB}\sin\beta + 100 = 0$

c. $T_{CA}(3.5)\sin\alpha = 100(1.5)$

d. $T_{CB}(3.5)\sin\alpha = 100(1.5)$

87.



The centroid of the hatched area from the base shown in the given figure is

a. d/2

b. 4d/6p

c. $\dfrac{10d}{3(8-\pi)}$

d. $\dfrac{3(8-\pi)d}{\quad}$

88. One ship A, sailing east with a speed of [illegible] km/h passes a certain point O at noon; a second ship B, sailing north at the same speed of 20 km h passes the same point O at 2 p.m. The shortest distance in km between them would be

a. $20/\sqrt{2}$

b. $\sqrt{20}$

c. $20\sqrt{2}$

d. $40\sqrt{2}$

89. A wheel of diameter 2 m is rolling without slip on a horizontal surface. The instantaneous velocity of the centre of the wheel is 1 m/s and the rotation is 4 rad/s. The instantaneous velocity of the point of contact of the wheel with the surface would be

a. Zero

b. 1m/s

c. 2 m/s

d. 4m/s

90. A planning machine table weighing mass 500 kg. It attains a speed of 0.[illegible] m/s in a distance of 400 [illegible] m from rest. If the acceleration due to gravity is 10 m/s^2 and the coefficient of friction between table and the bed is 0.1, then the maximum effort required to drive the table will be

a. [illegible]N

b. [illegible]0N

c. [illegible]500N

d. [illegible]500N

91. Two points A and B are 50 m apart on an inclined hill track having a slope of 1 to 5. A car of mass 1000 kg descends from A to B. The car with a velocity of 20 m/s at A is brought to rest at B by a force. If the acceleration due to gravity is 10 m/s^2, then the total energy destroyed by the force will be

a. 2×10^4 J

b. 3×10^5 J

c. 1.5×10^5 J

d. 2.5×10^5 J

92. A sphere impinges directly on another sphere of same mass at rest. If the coefficient of restitution is half, then their velocities after impact will be in the ratio of

a. 1:2

b. 2:1

c. 3:1

d. 1:3

93. A circular disk and a circular ring have the same radius and mass If the moments of inertia of the disk and ring about its diameter are respectively I_1 and I_2 then

a. $I_1 = 2I_2$

b. $I_1 = I_2$

c. $I_1 < I_2$

d. $I_1 > I_2$

94. A particle is executing simple harmonic motion of amplitude δ. The displacement from the mean position at which the energy will be half kinetic and half potential, is

a. $\delta/\sqrt{2}$

b. $\delta/2$

c. $\sqrt{2}\delta$

d. 2δ

95. A 6.5 kg sphere constrained to move along frictionless guides, moves at a speed of 4 ms towards a 26 kg block resting against a buffer spring. Assuming that there is no loss of energy at impact, the final velocities of sphere and block respectively will be

a. zero and zero

b. –2.4 m/s and 1.6 m/s

c. –1.6m/s and 2.4m/s

d. Nor determinable as the stiffness of the buffer spring is not given

96. March List I with List II and select the correct answer:

List I

A. Ratio of lateral strain to linear strain

B. Ratio of stress to strain

C. Ratio of extension to original length

D. Ratio of axial pull to area of section

List II

1. Strain
2. Poisson's ratio
3. Tensile stress
4. Young's modulus

	A	B	C	D
a.	4	2	3	1
b	4	2	1	3
c.	2	4	3	1
d.	2	4	1	3

97. Assume that Young's modulus of steel is twice that of brass. Two bars of brass and a bar of steel of equal cross-section form a single tension member with the help of rigid pins s shown in the figure

The shear in the pin will be

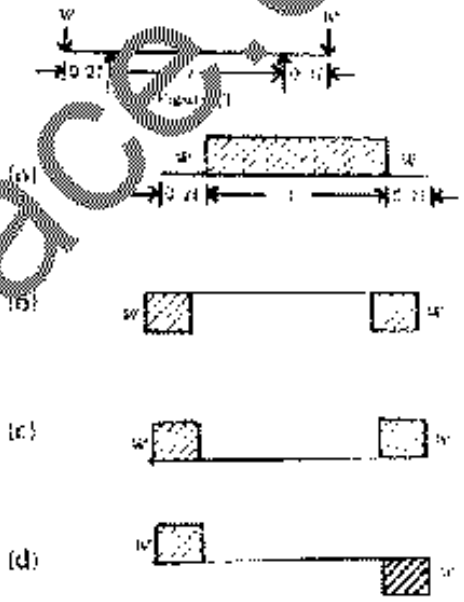
a. 0.25 P

b. 0.5 P

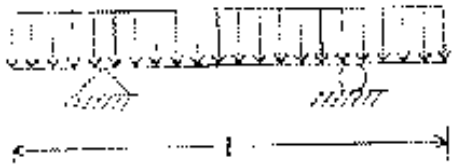
c. 0.33 P

d. 0.4 P

98. Which one of the following represents the correct shear force diagram of the simply supported beam shown in figure (1)?



99.



A simply supported beam with equal overhang on both sides is loaded as shown in the figure. If the bending moment at mid span is zero, then the percentage overhang on each side will be

a. 33.3

b. 25

c. 20

d. 15

100. For a material which is very strong in compression and very weak in tension, the ideal shape of the cross-section to resist bending moment will be let

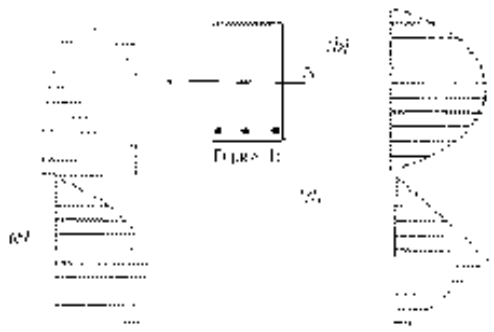
a. I-section

b. Circular

c. I-section

d. Rectangular

101 Assuming that concrete will not take any tension, which one of the following shear stress diagrams for the reinforced concrete rectangular section shown in figure (I) is correct?



102. Match List I with List II and select the correct answer:

List I (Beam/Column and loading)

A. Propped cantilever beam under mid-point loading

B. Fixed beam under uniformly distributed load

C. Fixed beam subjected to a moment at mid-point

D. Simply supported column subjected to eccentric load at an intermediate point

List II (Number of point of contra-flexure)

1. Two
2. Three
3. One
4.

	A	B	C	D
a.	3	2	1	3
b.	3	2	3	1
c.	2	3	3	1
d.	2	3	1	3

103 A 6-metre long uniform cantilever beam carries a load of 8 tones uniformly distributed over its whole length. If the free end of the cantilever is to be propped up to the level of the fixed end, then the force (in tones) required at the prop will be

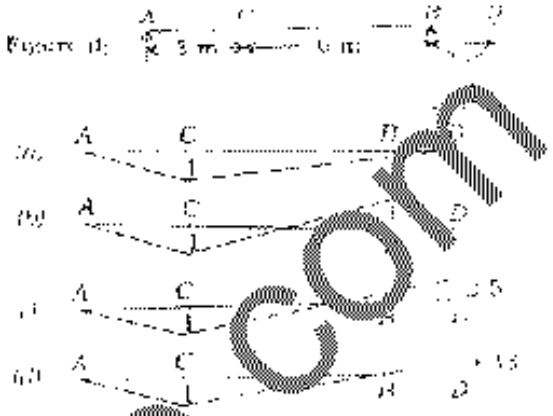
a. 3

b. 4

c. 6

d. 8

104. Which one of the following represents the correct influence line for bending movement at point C for the beam shown in figure (I)?



105. Consider the following statements with respect to the arch:

1. The normal thrust at any section of the arch is the component of interacting forces on the section along the tangent to the centre line of the arch.
2. The radial shear at any section of the arch is the component of the interacting forces on the section along the normal to the centre line of the arch.
3. The intercept between a given arch and the linear arch at a section is proportional to the bending moment at the section.

Of these statements

a. 1, 2 and 3 are correct

b. 1 and 2 are correct

c. 2 and 3 are correct

d. 1 and 3 are correct

106. A symmetrical parabolic arch of span 20 meters and rise 5 meters is hinged at the springing. It supports a uniformly distributed load of 2 tones per meter run of the span. The horizontal thrust in tones at each of the springing is

a. 8

b. 16

c. 20

d. Zero

107. Three equally inclined members of a plane frame having tensile forces P_1, P_2 and P_3

respectively are joined at a point. The relationship between P_1 P_2 and P_3 will be

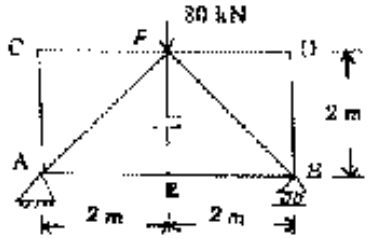
a. $P_2 = 0$ *and* $P_3 = P_1$

b. $P_2 = P_1$ *and* $P_3 = 0$

c. $P_2 = \sqrt{3}/2\,P_1$ *and* $P_3 = \sqrt{3}/2\,P_1$

d. $P_2 = P_1$ *and* $P_3 = P_1$

108



A simply supported truss shown in the given figure carries a load of 20 kN at E. The forces in the members EF and BE are respectively

a. Zero and 10 kN (Compression)

b. Zero and 10 kN (Tension)

c. 10 kN (Tension) and 10 kN (Compression)

d. 10 kN (Compression) and 10 kN (Tension)

109 A solid circular shaft is subjected to bending moment M and twisting moment M_t. The ratio of maximum shearing stress and maximum bending stress is equal to

a. $2M_t / M$

b. $M_t / 2M$

c. $M / 2M_t$

d. $2M / M_t$

110 A close-coiled spring is cut into two identical halves. The stiffness of each of the resulting springs will

a. Remain the same as that of the original spring

b. Reduce to half that of the original spring

c. Become twice that of the original spring

d. Become zero.

111 The volumetric strain of a cylindrical shell with an internal pressure is equal to

a. 2 longitudinal strain + net circumferential strain

b. 2 longitudinal strain + ½ net circumferential strain

c. 1/2 longitudinal strain + 2 net circumferential strain

d. longitudinal strain + 2 net circumferential strain

112. A beam made of steel is subjected to pure bending. Yielding of the material in the beam will take place when the maximum bending stress is equal to

a. Two times the yield stress of steel

b. $\sqrt{2}$ times the yield stress of steel

c. Half the yield stress of steel

d. The yield stress of steel

113. A beam AB is fixed at both ends and carries a uniformly distributed load of intensity p per unit length run over its entire length. Due to some constructional defects, the end B is now reduced to a simple support. The percentage increase in bending moment at A is

a. 25

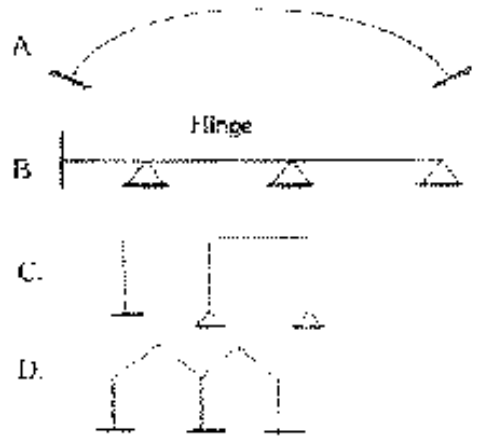
b. 50

c. 75

d. 100

114. Match List I with List II and select the correct answer

List I (Structure)



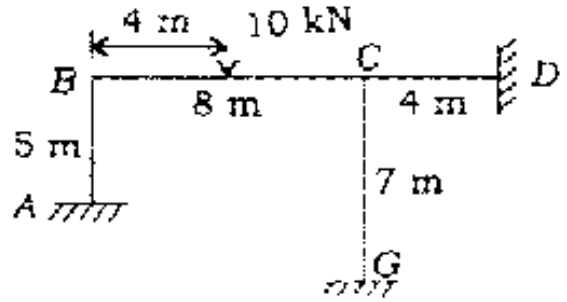
List II (Degree of static indeterminacy)

1. Three
2. Six
3. Two
4. Four

	A	B	C	D
a	1	3	2	4
b.	3	1	2	4

c.	3	1	4	2
d	1	3	4	2

115.



The distribution factors for members CB, CD and CG for the frame shown in the figure (EI constant) will be respectively

a. 0.24, 0.28 and 0.48

b. 0.24, 0.48 and 0.28

c. 0.48, 0.24 and 0.28

d 0.28, 0.48 and 0.24

116 A fixed beam AB is subjected to a triangular load varying from zero at end A to w per unit length at end B. The ratio of fixed end moment at B to A will be

a. 1/2

b 1/3

c. 2/3

d. 3/2

117. A simply supported beam of rectangular cross-section supports a point load at its mid-span. If the width of the section is doubled, then the maximum deflection in the beam will be N times the deflection of the original beam, where the value of N is

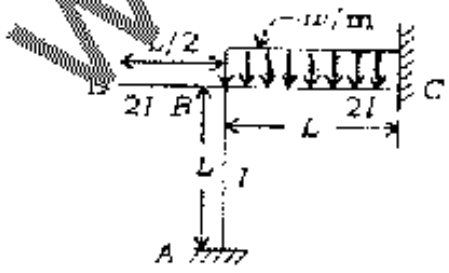
a. 0.5

b. 1

c. 2

d.

118



The slop deflection equation of member BC of the frame shown in the figure is

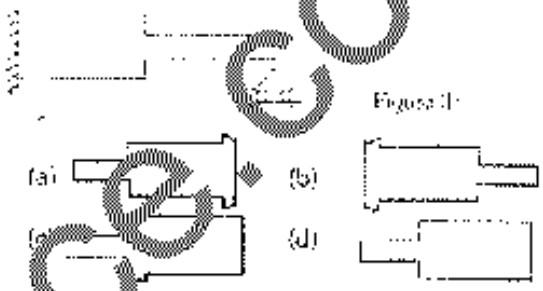
a. $M_{BC} = -\frac{wL^2}{24} + \frac{2EI\theta_B}{L} + \frac{4EI\theta_B}{L}$

b. $M_{BC} = \frac{wL^2}{12} + \frac{4EI\theta_B}{L} + \frac{8EI\theta_B}{L}$

c. $M_{BC} = -\frac{wL^2}{8} + \frac{EI\theta_C}{L} + \frac{4EI\theta_B}{L}$

d. $M_{BC} = \frac{wL^2}{12} + \frac{2EI\theta_C}{L} + \frac{2EI\theta_B}{L}$

119. Which one of the following is the correct analogous column shape for the propped cantilever shown in figure (1)



120. Consider the following statements:

1. An influence line for a function (example : moment, shear force, reaction, deflection) in a structure is a curve which shows its variation at particular section of the structure for various positions of a moving unit load.
2. The influence line for bending moment/shear force must not be confused with bending moment diagram and shear force diagram for the structure.
3. The bending moment diagram and shear force diagram show the moment/shear values at all sections of the structure. The influence line diagram for BM/SF is always drawn for a moving unit point load and for a particular section only.

a. 1, 2 and 3 are correct

b. 1 and 2 are correct

c. 2 and 3 are correct

d. 1 alone is correct