

**Civil Engineering**

**RT -20-11-2016**

1. Tensile strength of wood is
  - (a) Maximum in the direction parallel to grains
  - (b) Minimum in the direction parallel to grains
  - (c) Maximum in the direction across the grains
  - (d) The same in all the directions
  
2. Which type of cement is most adaptable for underwater constructions?
  - (a) Rapid Hardening cement
  - (b) Ordinary Portland cement
  - (c) Low-heat Portland cement
  - (d) Blast furnace slag cement
  
3. Green colour of cement is caused by
  - (a) Iron oxide
  - (b) Magnesium oxide
  - (c) Chromium dioxide
  - (d) Carbon pigments

4.

Super-plasticizers are

- (a) Additives applied to bitumen to achieve a low melting point
- (b) Water-reducing admixtures for concrete
- (c) Additives applied to bitumen to improve its viscosity
- (d) Accelerating admixtures

5.

Reducing water/cement ratio in concrete during manufacture results in

- (a) Increase in 28 days compressive strength
- (b) Decrease in 28 days compressive strength
- (c) No change in 28 days compressive strength
- (d) Significant increase in tensile strength

6.

A hollow steel column has an external diameter of 250 mm and an internal diameter of 200 mm. If the safe compressive stress is  $120 \text{ N/mm}^2$ , the safe axial compressive load for the column is, nearly

- (a) 2210 kN
- (b) 2120 kN
- (c) 2000 kN
- (d) 1500 kN

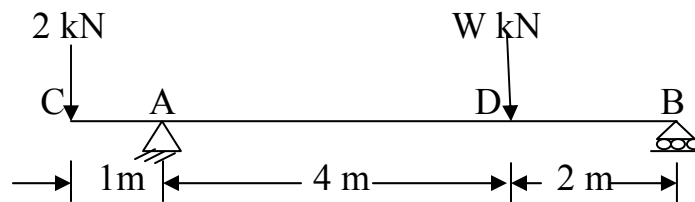
7.

A material has a Young's Modulus of  $1.25 \times 10^5 \text{ N/mm}^2$  and a Poisson's ratio of 0.25. The Modulus of Rigidity is

- (a)  $0.65 \times 10^5 \text{ N/mm}^2$
- (b)  $0.60 \times 10^5 \text{ N/mm}^2$
- (c)  $0.50 \times 10^5 \text{ N/mm}^2$
- (d)  $0.45 \times 10^5 \text{ N/mm}^2$

8.

Beam AB is supported as shown at A and B and has an overhang AC; and it carries loads as shown in the figure. Which of the following will give the value of W so that  $R_A = R_B$ ?



- (a) 4 kN
- (b) 6 kN
- (c) 8 kN
- (d) 10 kN

9.

A rectangular block is subjected to bi-axial principal stresses of intensity  $\sigma_x$  and  $\sigma_y$ , both tensile, with  $\sigma_y > \sigma_x$ . Which of the following will give the radius of the Mohr's circle?

- (a) Minimum shear stress
- (b) Maximum shear stress
- (c) Minimum Normal stress
- (d) Maximum Normal stress

10.

In a linear strain system, strain in a direction  $\theta$  with  $X$ -direction (where  $\epsilon_x$  is the strain in  $X$ -direction) is

- (a)  $\epsilon_x \cos \theta$
- (b)  $\epsilon_x \sin \theta$
- (c)  $\epsilon_x \cos^2 \theta$
- (d)  $\epsilon_x \sin^2 \theta$

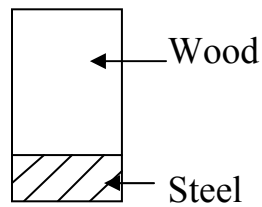
11.

A control sluice 4 m wide across a rectangular channel carries water at  $16.0 \text{ m}^3/\text{sec}$ . The limiting flow velocity for a hydraulic jump to occur is:

- (a)  $1.45 \text{ m/sec}$
- (b)  $2.44 \text{ m/sec}$
- (c)  $3.42 \text{ m/sec}$
- (d)  $4.16 \text{ m/sec}$

12.

A composite rectangular beam of wood ( $E_1 = 10 \text{ GPa}$ ) and steel ( $E_2 = 200 \text{ GPa}$ ) bonded together is shown in the figure.



Which of the following statements are correct when the beam is under flexure?

1. Strains vary linearly along the depth
  2. Longitudinal stresses depend on elastic moduli
  3. At the interface, the two materials will be stressed to the same extent
  4. Neutral axis will be at mid-depth
- (a) 1 and 4  
(b) 2 and 3  
(c) 2 and 4  
(d) 1 and 2

13.

In order to reduce uplift on a gravity dam, the type of grouting done is

- (a) Consolidation grouting near the heel
- (b) Curtain grouting near the toe
- (c) Consolidation grouting near the toe
- (d) Curtain grouting near the heel

14.

In the standard *SCS-CN* method of modelling runoff due to daily rainfall, the maximum one-day rainfall that would not produce runoff in a watershed with  $CN = 50$  is nearly

- (a) 25 mm
- (b) 35 mm
- (c) 50 mm
- (d) 65 mm

15.

A waste-water sample contains 30 *mg/l* toxic material, 300 *mg/l* biodegradable organic material and 100 *mg/l* of inorganic material. Its *BOD* will be

- (a) 0 *mg/l*
- (b) 300 *mg/l*
- (c) 400 *mg/l*
- (d) 430 *mg/l*

16.

If the intensity of sound wave is  $I$ , and the area perpendicular to the direction of wave motion is  $a$ , the power of the sound wave  $W$  is

- (a)  $\frac{I}{a}$
- (b)  $\frac{I^2}{a}$
- (c)  $I \times a$
- (d)  $I^2 \times a$

17.

Consider the following statements:

1. Undrained shear strength of saturated clay is independent of total stress
2. Unconfined compression test is classified as unconsolidated undrained test
3. Unconfined compression test is applicable to soil specimen which is fissured

Which of the above statements are correct?

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

18.

Consider the following methods of analysis:

1. Method of consistent deformation
2. Column analogy method
3. Equilibrium method
4. Three-moment equation

Which of the above methods come under the category of force method?

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

19.

A suspension bridge with a two-hinged stiffening girder is

- (a) Statically determinate
- (b) Indeterminate by one degree
- (c) Indeterminate by two degrees
- (d) A determinate structure

20.

By what height will water rise by capillary action in a glass tube of  $2.2 \text{ mm}$  bore, given that surface tension at the ambient temperature is  $0.078 \text{ g/cm}$ ? Assuming  $\theta = 0^\circ$  for water at glass

- (a)  $1.68 \text{ cm}$
- (b)  $1.60 \text{ cm}$
- (c)  $1.52 \text{ cm}$
- (d)  $1.42 \text{ cm}$

21.

A pipe line conveys a discharge  $Q$  from a river intake to a city at a lower level through a pipe length  $L$ , diameter  $d$  and friction coefficient  $f$ . If an identical pipe is laid parallel to this pipe for  $\frac{3}{4}L$  and suitably connected to this pipe at  $L/4$  from the upstream end, what percentage increase of  $Q$  will be realized if all other conditions remain the same, and only friction loss is considered throughout?

- (a) 51 %
- (b) 55 %
- (c) 58 %
- (d) 61 %

22.



Bearing stiffeners in plate girders are provided at

- (a) Mid-span
- (b) Quarter point
- (c) Equal intervals
- (d) Supports

23.

Effective throat size of a fillet is

- (a) A function of the angle between the fusion sides
- (b) Equal to the hypotenuse of the weld triangle
- (c) The perimeter of the weld divided by the size of the weld
- (d) 0.707 times the size of the weld

24.

Diameter of a bolt hole is usually taken as

- (a) Gross diameter of bolt
- (b) Nominal diameter + 1.5 mm
- (c) Nominal diameter + 2.0 mm
- (d) Nominal diameter of bolt

25.

Intermediate vertical stiffeners are provided in a plate girder if the web thickness in terms of  $d$  (distance between the flanges) is

- (a)  $\frac{d}{165}$
- (b)  $\frac{d}{115}$
- (c)  $\frac{d}{85}$
- (d)  $\frac{d}{65}$

26.

Bending compressive and tensile stresses respectively are calculated based on

- (a) Bending moment
- (b) Shear force
- (c) Shear force and bending moment
- (d) Torsion

27.

Lacing bars in a built-up steel column should be designed to resist

- (a) Axial force
- (b) Shear force
- (c) Bending moment
- (d) Torsion

28.

The stage at which the tendon force is released on concrete permanently is called

- (a) Pre-tensioning
- (b) Post-tensioning
- (c) Anchoring
- (d) Transfer

29.

The loss of prestress due to elastic shortening of concrete is least in

- (a) One wire pre-tensioned beam
- (b) One wire post-tensioned beam
- (c) Multiple wire pre-tensioned beam with sequential cutting of wires
- (d) Multiple wire post-tensioned beams subjected to sequential pre-stressing

30.

Grouting of ducts in post-tensioned concrete construction causes

- (a) Reduction in pre-stress
- (b) Increase in pre-stress
- (c) Reduction in corrosion
- (d) Increase in corrosion

31.

A concrete beam of rectangular cross-section of  $200\text{ mm} \times 400\text{ mm}$ , is prestressed with a force of  $400\text{ kN}$  at an eccentricity of  $100\text{ mm}$ . The maximum compressive stress in the concrete is

- (a)  $3.5\text{ N/mm}^2$
- (b)  $5.5\text{ N/mm}^2$
- (c)  $8.5\text{ N/mm}^2$
- (d)  $12.5\text{ N/mm}^2$

32.

The root zone of a crop in a certain soil has a field capacity of 45 % and permanent wilting point of the crop thereon is 8 %. The dry unit weight of the soil and the root zone depth are  $15\text{ kN/m}^3$  and  $1.24\text{ m}$ , respectively. The available depth of water for the crop will be

- (a)  $0.5\text{ m}$
- (b)  $0.6\text{ m}$
- (c)  $0.7\text{ m}$
- (d)  $0.8\text{ m}$

33.

In respect of two-dimensional flow of an incompressible fluid, consider the superposition of a linear flow having uniform velocity  $U$  parallel to the  $x$ -axis on a source of strength  $m$ . The distance between the stagnation point and the source is

- (a)  $\frac{2m}{\pi U}$
- (b)  $\frac{2U}{\pi m}$
- (c)  $\frac{m}{2\pi U}$
- (d)  $\frac{\pi m}{2U}$

34.

Type of joint preferred in a single brick wall to save facing bricks is

- (a) English bond
- (b) Flemish bond
- (c) Garden-wall bond
- (d) Stretcher bond

35.

In tunneling works, the most economical method of concreting is through

- (a) Dump trucks
- (b) Belt conveyors
- (c) Chutes
- (d) Concrete pumps

36.

Consider the following statements:

1. Sheepsfoot roller suitable for compacting clays
2. Sheepsfoot roller is self-propelling
3. Vibrating rollers are suitable for densifying sands
4. Sheepsfoot roller works on the rolling principle

Which of the above statements are correct?

- (a) 2 and 3
- (b) 2 and 4
- (c) 1 and 3
- (d) 1 and 4

37.

Which of the following types of pump can be used for concreting?

1. Centrifugally operated with straight blades
2. Pneumatically operated

- (a) 1 only
- (b) 2 only
- (c) Both 1 and 2
- (d) Neither 1 nor 2

38.

Consider the following statements in respect of incubation bottles for BOD analysis:

1. The bottles should be equipped with glass stoppers that are ground to a point to prevent trapping of air when the stopper is inserted
2. The bottles should be equipped with some form of water seal to prevent air escape from the bottle during the incubation period
3. Bottles should be free of organic matter
4. Cleaning is done by chromic acid or detergent of good quality and well rinsed thereafter

Which of the above statements are correct?

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

39.

A stream has a width of  $30\text{ m}$ , depth of  $3\text{ m}$  and a mean velocity of  $1.25\text{ m/sec}$ . What is the height of a weir to be built on the stream floor so as to cause an afflux of  $1\text{ m}$ ? Assume value of discharge coefficient as  $0.95$ .

- (a)  $3.594\text{ m}$
- (b)  $2.787\text{ m}$
- (c)  $4.312\text{ m}$
- (d)  $1.956\text{ m}$

40.

A city being currently supplied with water from a reservoir behind a nearby hill. The present supply is through a pipeline  $300\text{ m}$  long,  $20\text{ cm}$  diameter, with  $f$  (having increased due to ageing to a current value of)  $0.042$ . To improve on the current supply of nearly  $2400\text{ m}^3/\text{day}$ , the city administration wishes to replace the existing system with a  $320\text{ m}$  long,  $22\text{ cm}$  pipe line with  $f$  value of  $0.028$ . What could be the approximate expected supply after this replacement? All other conditions remain the same, and minor losses can be neglected in both the cases for purposes of their immediate computations?

- (a)  $3200\text{ m}^3/\text{day}$
- (b)  $3310\text{ m}^3/\text{day}$
- (c)  $3610\text{ m}^3/\text{day}$
- (d)  $3950\text{ m}^3/\text{day}$

41.

Which one of the following bricks is used for lining of furnaces?

- (a) Over- burnt bricks
- (b) Under- burnt bricks
- (c) Refractory bricks
- (d) First quality bricks

42.

A split tensile test is performed on a concrete cylinder of diameter  $D$  and length  $L$ . If the ultimate load is  $P$ , then the splitting tensile strength of concrete is

(a)  $\frac{P}{\pi D L}$

(b)  $\frac{2 P}{\pi D L}$

(c)  $\frac{4 P L}{\pi D^3}$

(d)  $\frac{2 P D}{\pi L^3}$

43.

A thin cylinder of diameter  $d$  and thickness  $t$  with closed ends is subjected to an internal pressure  $p$ . If shear stress is restricted to  $q$ , what is the maximum permissible value of  $p$ ?

(a)  $\frac{2 q t}{d}$

(b)  $\frac{4 q t}{d}$

(c)  $\frac{8 q t}{d}$

(d)  $\frac{16 q t}{d}$

44.

A structural element is subjected to pure shear of  $125 \text{ N/mm}^2$ . The yield stresses in tension as well as compression are both  $250 \text{ N/mm}^2$ . What would be the factor of safety, in tension and compression, according to maximum normal stress theory?

(a) 2.5 and 2

(b) 2 and 2.5

(c) 2.5 and 2.5

(d) 2 and 2



45.

A steel beam having  $I$  cross-section has an overall depth of  $300\text{ mm}$ . The top and bottom flange widths are  $120\text{ mm}$  each. If the flange stresses at the top and bottom are  $120\text{ N/mm}^2$  and  $30\text{ N/mm}^2$ , respectively, the depth of the neutral axis from the top of the beam would be

- (a)  $60\text{ mm}$
- (b)  $120\text{ mm}$
- (c)  $180\text{ mm}$
- (d)  $240\text{ mm}$

46.

A beam of rectangular cross-sectional dimensions  $250\text{ mm} \times 300\text{ mm}$  is subjected to a shear force of  $75\text{ kN}$ . The intensity of maximum shear stress in the cross-section is

- (a)  $1.5\text{ N/mm}^2$
- (b)  $2.0\text{ N/mm}^2$
- (c)  $2.2\text{ N/mm}^2$
- (d)  $2.5\text{ N/mm}^2$

47.

A circular shaft, when subjected to torsion, undergoes a twist of  $1^\circ$  in a length of  $1.2\text{ m}$ . The modulus of rigidity of the shaft is  $0.8 \times 10^5\text{ N/mm}^2$ . If the maximum shear stress induced in the shaft is  $80\text{ N/mm}^2$ , the radius of the shaft should be

- (a)  $\frac{108}{\pi}$
- (b)  $\frac{144}{\pi}$
- (c)  $\frac{216}{\pi}$
- (d)  $\frac{266}{\pi}$

48.

The shape factor of a rectangular section is

- (a) 0.5
- (b) 1.0
- (c) 1.5
- (d) 2.0

49.

Study of project duration probabilities may become 'pointless' in situations where:

1. There exist several components of WBS
2. There exists cross inputs from one WBS to another as regards milestone events
3. Inputs from other infrastructure projects are essential for the progress of the project under consideration
4. Regarding project inventory, situations may prevail where both supply and demand of input materials are deterministic

The severity of these causes to contribute to the 'pointlessness' mentioned above is gradable (most severe to least severe) in most cases as:

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

50.

It can be stated in general that if a statically indeterminate frame has  $R$  redundancy, then it will become statically determinate if the number of plastic hinge formed is

- (a)  $R$
- (b)  $R - 1$
- (c)  $R + 1$
- (d)  $2R$

51.

Study of impact of jets and of velocity triangles is based on Newton's law which states: Force = mass  $\times$  acceleration. For practical applications, the following features are emphasized.

1. Change of velocity takes place in a finite time duration
2. Rather than the 'mass', the ratio of 'weight' and 'g' is used.
3. Change of velocity normal to the direction of the impacting inflow is also relevant to the computations

Which of the above are correct?

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

52.

Consider the following statements:

1. The deformation of structures subjected to several simultaneously applied loads may be obtained by algebraically summing the deformations due to the individual loads.
2. Such superposition holds both for linear and nonlinear systems.

Which of the above statements is/are correct?

- (a) 1 only
- (b) 2 only
- (c) Both 1 and 2
- (d) Neither 1 nor 2

53.

Water is supplied from a height of  $5.2\text{ m}$  at the rate of  $100\text{ lps}$  to a hydraulic ram that delivers  $7\text{ lps}$  to a height of  $24\text{ m}$  above the ram. The head loss at the supply pipe is  $0.2\text{ m}$  and the delivery pipe has a loss of  $1.0\text{ m}$ . The efficiency of the ram is

- (a) 22.8 %
- (b) 29.8 %
- (c) 35.0 %
- (d) 39.6 %

54.

A strata of normally consolidated clay of 3 m depth is drained at both the ends. The coefficient of permeability is  $5 \times 10^{-8} \text{ cm/s}$  and the coefficient of volume compressibility is  $125 \times 10^{-2} \text{ cm/kN}$  for the said clay. If the clay layer is subjected to a uniformly distributed load of  $250 \text{ kN/m}^2$ , what is the time required for 80 % consolidation?

- (a) 55.2 days
- (b) 36.9 days
- (c) 156.0 days
- (d) 220.8 days

55.

A turbine develops 500 kW power under a net head of 30 m. If the overall efficiency of the turbine is 0.83, the discharge through the turbine is nearly

- (a)  $3.5 \text{ m}^3/\text{s}$
- (b)  $3.0 \text{ m}^3/\text{s}$
- (c)  $2.5 \text{ m}^3/\text{s}$
- (d)  $2.0 \text{ m}^3/\text{s}$

56.

A single-acting reciprocating pump, running at 50 rpm delivers  $0.01 \text{ m}^3/\text{s}$  of water. The diameter of the piston is 200 mm and the stroke length is 400 mm. The theoretical discharge of the pump is

- (a) 10.5 l/s
- (b) 14.0 l/s
- (c) 17.5 l/s
- (d) 21.0 l/s

57.

The Hardy Cross method of analysis of pipe net works requires that:

1. Flow into any junction equals the flow out of it
2. Flow in each pipe has head loss according to respective flow equations
3. Momentum principle is followed in each loop
4. Algebraic sum of the head losses around any closed loop is zero

Which of the above statements are correct?

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

58.

A rectangular open channel of width  $4.5\text{ m}$  is carrying a discharge of  $100\text{ m}^3/\text{s}$ . The critical depth of the channel  $y_c$  is, nearly

- (a)  $3.4\text{ m}$
- (b)  $3.7\text{ m}$
- (c)  $4.0\text{ m}$
- (d)  $4.2\text{ m}$

59.

The prototype discharge through a weir is  $1.5\text{ m}^3/\text{s}$ . The discharge in a model of the weir having a horizontal and vertical scale ratios as 1: 40 and 1: 10 is nearly

- (a)  $1.5\text{ lps}$
- (b)  $1.2\text{ lps}$
- (c)  $1.0\text{ lps}$
- (d)  $0.9\text{ lps}$

60.

It is desired not to allow any spill from a tank of size  $2m \times 2m \times 1m$  (height) carrying water up to the top and it is moved at a horizontal acceleration of  $4 m/s^2$  parallel to its sides. What percentage of increase in vertical side is needed to achieve the same?

- (a) 50 %
- (b) 41 %
- (c) 32 %
- (d) 24 %

61.

Rainfall of intensity  $0.2 m/hr$  fell on  $2.0 km^2$  area for  $4 hrs$ . Measured runoff during the period was  $2,500,870 m^3$ . What was the loss in total during the period?

- (a)  $440,386 m^3$
- (b)  $900,870 m^3$
- (c)  $540,246 m^3$
- (d)  $1,230,418 m^3$

62.

Consider the following statements:

1. Air masses get cooled in nature mainly because of contact with cooler bodies
2. Air masses lose heat as they get contracted at higher elevations
3. The type and intensity of the resulting precipitation is a function of the rate of adiabatic cooling

Which of the above statements are correct?

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

63.

Mean precipitation over an area is best obtained based on gauged data using:

- (a) Thiessen method
- (b) Arithmetic mean method
- (c) Linearly interpolated isohyetal method
- (d) Orographically weighed isohyetal method

64.

The rainfalls of 0.8, 1.6, 2.0 and 2.5 *cm* were recorded in successive 1 - *h* intervals. If the  $\phi_{index}$  for the storm was 1.2 *cm/h*, then the volume of runoff from a basin of 200 *km*<sup>2</sup> is

- (a) 2 *Mm*<sup>3</sup>
- (b) 3 *Mm*<sup>3</sup>
- (c) 4 *Mm*<sup>3</sup>
- (d) 5 *Mm*<sup>3</sup>



65.

The peak of a flood hydrograph due to a 2-hour duration isolated storm in a catchment is  $200 \text{ m}^3/\text{s}$ . The total depth of rainfall is  $5 \text{ cm}$  and the infiltration loss rate is  $1 \text{ cm/hr}$ . For a base flow of  $17 \text{ m}^3/\text{s}$ , the peak of the 2-hour unit hydrograph, is

- (a)  $41.0 \text{ m}^3/\text{s}$
- (b)  $44.7 \text{ m}^3/\text{s}$
- (c)  $61.0 \text{ m}^3/\text{s}$
- (d)  $66.7 \text{ m}^3/\text{s}$

66.

Consider the following statements:

1. If the moisture available is less than what the plants can transpire, the actual evapotranspiration is more
2. Potential evaporation from an area under a crop is usually computed as  $ET_c = \frac{E T_r}{C_f}$
3. The reference crop potential evapotranspiration is almost equal to the evaporation from an open surface of water body.

Which of the above statements is/are correct?

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

67.

In routing a flood through a reach the point of intersection of inflow and outflow hydrographs coincides with the peak of outflow hydrograph

- (a) In all cases of reservoir flood routing
- (b) When the inflow is into a reservoir with an uncontrolled outlet
- (c) When the inflow is into a reservoir with a controlled outlet
- (d) In channel routing only

68.

In a flood routing procedure, the coefficients of the Muskingum equation  $C_0$ ,  $C_1$  and  $C_2$  are determined. If the values of,  $C_0 = 0.1$  and  $C_1 = 0.4$ , what is the value of  $C_2$ ?

- (a) 0.3
- (b) 0.4
- (c) 0.5
- (d) 0.6

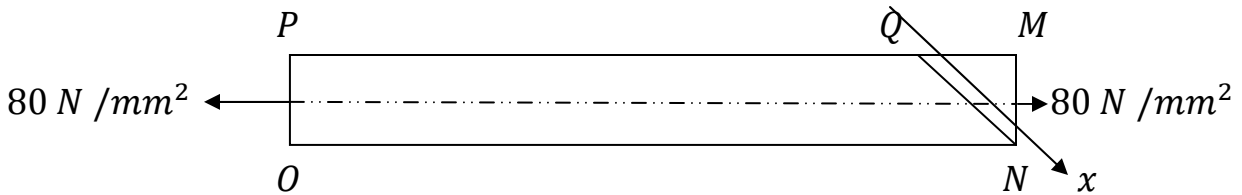
69.

For a gravel of median size 16 mm, the critical shear stress is about

- (a) 24 Pa
- (b) 15 Pa
- (c) 07 Pa
- (d) 03 Pa

70.

A mild steel bar of uniform cross-section is subjected to a uni-axial tensile stress of  $80 \text{ N/mm}^2$ . Consider a plane  $NQ$  making an angle of  $30^\circ$  with  $MN$ . What will be the normal stress and the tangential stress on the plane  $MQ$ ?



- (a)  $20\sqrt{3} \text{ N/mm}^2$  and  $80 \text{ N/mm}^2$
- (b)  $40 \text{ N/mm}^2$  and  $80 \text{ N/mm}^2$
- (c)  $20\sqrt{3} \text{ N/mm}^2$  and  $60 \text{ N/mm}^2$
- (d)  $40 \text{ N/mm}^2$  and  $60 \text{ N/mm}^2$

71.

The estimated hourly requirement for a day of maximum consumption in a small town is tabulated. Provision for fire-fighting is to be at  $62 \text{ lps}$  for a conflagration of  $3 \text{ hours}$ . What is the storage requirement for the distribution reservoir, if pumping is to start at  $0800 \text{ hours}$  and end at  $1400 \text{ hours}$ ?

Hours ending	0800	0900	1000	1100	1200	1300	1400
Demand $m^3$	415	430	472	524	448	410	390

- (a)  $3958.6 \text{ m}^3$
- (b)  $3469.6 \text{ m}^3$
- (c)  $3758.6 \text{ m}^3$
- (d)  $3069.6 \text{ m}^3$

72.

The dissolved oxygen in a water sample is estimated by modified Winkler method. A 200 ml volume of dissolved-oxygen-fixed solution is titrated with

- (a) Sodium thiosulfate reagent using soluble starch as an indicator
- (b) Sodium thiosulfate reagent using ferrion as an indicator
- (c) Ferrous ammonium sulfate reagent using soluble starch as an indicator
- (d) Ferrous ammonium sulfate reagent using ferrion as an indicator

73.

In water treatment both pre-, and post-, chlorination of water are done to control:

1. Colour
2. Odour
3. Water-borne diseases due to bacteria
4. Algae
5. Turbidity
6. TDS

Which of the above are correct?

- (a) 1, 2, 3 and 4
- (b) 2, 3, 4 and 5
- (c) 3, 4, 5 and 6
- (d) 1, 3, 5 and 6

74.

Disinfection of water helps in:

1. Removing turbidity
2. Removing hardness
3. Killing pathogenic bacteria
4. Complete sterilization

Which of the above is/are correct?

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

75.

Consider the following statements in respect of employing steel pipes in conveyance and distribution of water:

1. They cannot withstand high negative pressures or vacuum that may be created in them
2. They are easily affected by acidic and alkaline waters
3. Large size diameter pipes can be made of thin shells
4. They are widely used for distribution mains but seldom used for trunk mains

Which of the above statements are correct?

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

76.

What is the hydraulic retention time in an aeration tank having a volume of  $10,000 \text{ m}^3$  and receiving waste water discharge of  $50,000 \text{ m}^3$  per day?

- (a) 1.2 hours
- (b) 2.4 hours
- (c) 3.6 hours
- (d) 4.8 hours

77.

If threshold of hearing is  $0.0002 \mu \text{ bar}$ , what will be the SPL in decibels if sound pressure is  $200 \mu \text{ bar}$ ?

- (a) 110
- (b) 120
- (c) 130
- (d) 140

78.

In a residential house along a highway an effective strategy to control noise level is to

- (a) Construct boundary wall around the house
- (b) Placing metal sheets all around the house
- (c) Planting thick bushes all around the house
- (d) Planting trees around the house

79.

Consider the following statements:

1. Noise pollution is additive on a logarithmic scale
2. Noise propagates differently in different media

Which of the above statements is/are correct?

- (a) 1 only
- (b) 2 only
- (c) Both 1 and 2
- (d) Neither 1 nor 2

80.

Consider the following statements:

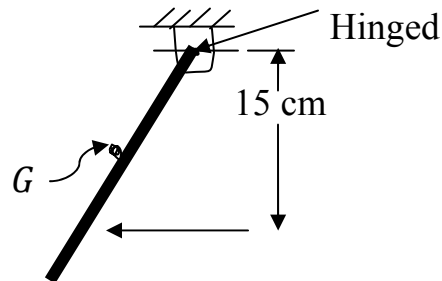
1. An ecosystem often gradually merges with an adjoining one through a transitional zone
2. Edge effect refers to additional species in an ecotone not found in most adjacent ecosystems.
3. Niche refers to the functional position of an organism in its ecosystem
4. In pond ecosystem benthos are found floating on the water surface

Which of the above statements are correct?

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

81.

A rectangular plate, weighing  $5\text{ kg}$ , is suspended by a hinge on the top horizontal edge. The centre of gravity  $G$  of the plate is  $10\text{ cm}$  from the hinged end. A horizontal jet of water of area  $5\text{ cm}^2$ , whose axis is  $15\text{ cm}$  below the hinge, impinges on the plate with velocity  $V\text{ m/sec}$ . In this condition, the plate deflects from the vertical by  $20^\circ$  ( $\sin 20^\circ = 0.34$ ,  $\cos 20^\circ = 0.94$ ). What will be the jet velocity? Take  $g = 10\text{ m/sec}^2$ .



- (a)  $4.9\text{ m/sec}$
- (b)  $5.2\text{ m/sec}$
- (c)  $5.5\text{ m/sec}$
- (d)  $5.7\text{ m/sec}$

82.

The total unit weight of the glacial soil is  $20\text{ kN/m}^3$  and specific gravity is  $2.68$ . The water content of the soil is  $19\%$ . The dry unit weight of the soil is nearly

- (a)  $19.9\text{ kN/m}^3$
- (b)  $16.8\text{ kN/m}^3$
- (c)  $13.7\text{ kN/m}^3$
- (d)  $10.6\text{ kN/m}^3$



83.

The specific gravity of solids in a soil sample is 2.75, and the void ratio is 1.0. If the value of  $\gamma_w$  is  $10 \text{ kN/m}^3$ , the value of dry unit weight of soil is

- (a)  $11.85 \text{ kN/m}^3$
- (b)  $13.75 \text{ kN/m}^3$
- (c)  $15.65 \text{ kN/m}^3$
- (d)  $17.55 \text{ kN/m}^3$

84.

The recommended compaction equipments for silty-soil with unified classification 'ML' are:

1. Vibratory drum roller
2. Vibratory rubber tyre roller
3. Pneumatic tyre roller
4. Vibratory sheep foot roller

Which of the above are correct?

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

85.

In pumping out test, the drawdown is  $5 \text{ m}$ . If the coefficient of permeability of the soil is  $10^{-4} \text{ m/s}$ , the radius of influence is

- (a)  $250 \text{ m}$
- (b)  $200 \text{ m}$
- (c)  $150 \text{ m}$
- (d)  $100 \text{ m}$

86.

Consider the following statements:

1. Settlement is not always an important criterion in ascertaining the load carrying capacity of a soil
2. Saturated sand deposits undergo significant consolidation settlement
3. The settlement of a clay soil is primarily through consolidation

Which of the above statements are correct?

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

87.

Which of the following assumptions were made by Terzaghi for analysis of one dimensional consolidation process?

1. The soil is homogeneous and non-saturated
  2. Soil particles as well as water are incompressible
  3. Co-efficient of permeability is invariant during consolidation
  4. Excess pore water drains out in all directions
- (a) 1 and 2
  - (b) 2 and 3
  - (c) 3 and 4
  - (d) 1 and 4

88.

Creep in soils may be predicted based on

1. Rheological models
2. Empirical method using creep data
3. Consolidation test data

Which of the above statements are correct?

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

89.

Consider the following statements in respect of a direct shear test:

1. The Mohr circle can be drawn for stress conditions prior to failure
2. The failure plane may not be the weakest plane
3. Control on drainage is possible during this test
4. The stresses are greater towards the centre of the sample
5. The side walls of the shear box cause lateral restraint on the specimen

Which of the above statements are correct?

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

90.

In hydrometer analysis for a soil mass

- (a) Both meniscus and dispersing agent corrections are negative
- (b) Both meniscus and dispersing agent corrections are positive
- (c) Meniscus correction is positive and dispersing agent correction is negative
- (d) Meniscus correction is negative and dispersing agent correction is positive

91.

If the intercept on a staff located at  $100\text{ m}$  from the level for a five divisions deviation of the bubble is  $0.050\text{ m}$  and if length of the one division of the bubble is  $2\text{ mm}$ , then the radius of curvature of the bubble is

- (a)  $15\text{ m}$
- (b)  $20\text{ m}$
- (c)  $25\text{ m}$
- (d)  $30\text{ m}$

92.

To find the true difference between points A and B on the opposite banks of a river, the level was set up near A and the staff readings on A and B were 2.635 and 4.247. The level was then moved and set up near B and the respective staff readings on A and B were 2.020 and 3.980. What is the true RL of B if RL of A is 400?

- (a) 405.464 m
- (b) 403.571 m
- (c) 401.782 m
- (d) 398.214 m

93.

In theodolite traversing for the calculation of independent rectangular coordinates from field observations, consider the following preliminary steps:

1. Computation of the reduced bearing of each traverse leg
2. Identifying the closing error
3. Balancing of consecutive coordinates
4. Calculation of consecutive coordinates

What is the correct sequence for above steps of computations?

- (a) 1 – 2 – 4 and 3
- (b) 3 – 2 – 4 and 1
- (c) 1 – 4 – 2 and 3
- (d) 3 – 4 – 2 and 1

94.

Consider the following factors suggested and relevant to remote sensing:

1. Frequency
2. Polarization
3. Incident angle
4. Scattering mechanism

Which of the above affect the microwave signatures of objects?

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

95.

The line passing through the optical center of the eye piece and the optical center of the object glass and its continuation is called

- (a) Trunnion axis of the telescope
- (b) Optical axis of the telescope
- (c) The line of collimation
- (d) Stadia line

96.

What is the correct order in which engineering surveys for highways shall be carried out?

1. Reconnaissance
  2. Final location and detailed surveys
  3. Map study
  4. Preliminary survey
- (a) 2 – 4 – 1 and 3
- (b) 3 – 1 – 4 and 2
- (c) 2 – 1 – 4 and 3
- (d) 3 – 4 – 1 and 2

97.

The angle of banking for a highway curve of 200 *m* radius designed for cars travelling at 120 *kmph*, taking the coefficient of friction between tyres and the road as 0.4, will be

- (a)  $\sin^{-1} 0.167$
- (b)  $\tan^{-1} 0.567$
- (c)  $\sin^{-1} 0.567$
- (d)  $\tan^{-1} 0.167$

98.

What is the extra widening required on a two-lane pavement for a curve of radius  $100\text{ m}$ . The wheelbase of the design vehicle is  $6\text{ m}$  and the design speed is  $64\text{ kmph}$ ?

- (a)  $1.0\text{ m}$
- (b)  $1.4\text{ m}$
- (c)  $1.8\text{ m}$
- (d)  $2.0\text{ m}$

99.

Two tanks  $A$  and  $B$ , with  $B$  at a constant lower water level of  $2.5\text{ m}$  relative to  $A$ , are connected by two pipes in series – pipe 1 from  $A$  being  $20\text{ m}$  long and  $10\text{ cm}$  diameter, followed by pipe 2,  $10\text{ m}$  long and  $8\text{ cm}$  diameter, leading to  $B$ . Neglect all minor losses, take  $f = 0.02$  and  $g = 10\text{ m/s}^2$ . The flow velocity through the  $8\text{ cm}$  pipe is nearly

- (a)  $3.0\text{ m/s}$
- (b)  $2.8\text{ m/s}$
- (c)  $2.3\text{ m/s}$
- (d)  $2.0\text{ m/s}$

100.

Dorry abrasion test registered a loss in weight of  $27\text{ g}$ . The respective coefficient of hardness will be

- (a) 11
- (b) 10
- (c) 9
- (d) 8