

# CIVIL ENGINEERING

1. Bearing plates are used to fix
  - a. Flat footed rails to wooden sleepers
  - b. Double headed rails to wooden sleepers
  - c. Bull headed rails to wooden sleepers
  - d. Flat footed rails to cast iron sleepers
2. The absolute minimum radius for horizontal curve designed for a speed of 100 kmph given the permissible values of super elevation 0.08 and coefficient of friction 0.12 will be
  - a. 252 m
  - b. 295 m
  - c. 394 m
  - d. 364 m
3. When the speed of the traffic flow becomes zero, then
  - a. Traffic density attains its maximum value whereas traffic volume becomes zero
  - b. Traffic density and traffic volume both attains respective maximum values
  - c. Traffic density and traffic volume both become zero
  - d. Traffic density becomes zero whereas traffic volume attains its maximum value
4. If the load carried by a CBR specimen at 2.5 mm penetration is  $37 \text{ kg/cm}^2$ , the CBR of the soil is
  - a. 10%
  - b. 35%
  - c. 50%
  - d. 70%
5. Given that:
  - $R$  = radius of load distribution
  - $E$  = modulus of elasticity of concrete
  - $K$  = modulus of sub grade reaction
  - $\mu$  = poisson's ratio of concrete
  - $t$  = thickness of slab
  - $p$  = wheel load

The combination of parameters required for obtaining the radius of relative stiffness of a cement concrete slab is

  - a.  $E, k, \mu, t$
  - b.  $E, h, k, \mu$
  - c.  $H, k, \mu, t$
  - d.  $P, h, k, \mu$
6. The best direction of a runway is
  - a. Along the longest line on the wind rose diagram
  - b. Along the direction perpendicular to the longest line on the wind rose diagram
  - c. At  $30^\circ$  to the direction of the longest line on the wind rose diagram
  - d. Along the NW - S line
7. Which of the following statements regarding ballast materials are correct?
  1. Brick ballast has poor drainage characteristics
  2. Coal ash is not used as ballast with steel or cast iron sleepers
  3. Gravel ballast gives better performance in wet formation
  4. Sand and ballast causes excessive wear on top of the rails

Select the correct answer using the codes given below

  - a. 1 and 2
  - b. 1 and 4
  - c. 1 and 3
  - d. 2, 3 and 4
8. The sleeper density of a BG tank is  $(n + 6)$  in metric units. The number of sleepers per 1.024 km of track is
  - a. 1520
  - b. 1630
  - c. 1720
  - d. 1800
9. If the capillary rise of water in a 1 mm diameter tube is 3 cm, the height of capillary rise of water in a 0.2 mm diameter tube in cm will be
  - a. 1.5
  - b. 7.5
  - c. 15
  - d. 75
10. A cylindrical gate rests on the crest of a spillway and water stands up to the top of the gate. Diameter of the gate is 1 m. The vertical component of the pressure force per meter length of the gate is
  - a.  $\pi/8 \text{ kN}$
  - b.  $\pi/4 \text{ kN}$
  - c.  $\pi/2 \text{ kN}$

d.  $\pi kN$ 

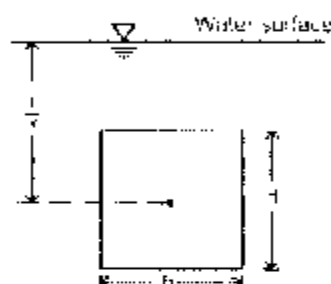
11. Pressures have been observed at four different points in different units of measurements as follows:

- A. 150 kPa  
 B. 1800 millibars  
 C. 20 m of water  
 D. 1240 mm of mercury (sp. Gr. 13.6)

Points arranged in descending order of magnitude of pressures are:

- a. B, D, A, C  
 b. B, C, D, A  
 c. C, B, D, A  
 d. C, A, B, D

12.



A vertically immersed surface is shown in figure. The distance of its centre of pressure from the water surface is

- a.  $\bar{X} + \frac{d^2}{12\bar{X}}$   
 b.  $\frac{b^2}{12\bar{X}} + d$   
 c.  $\frac{d}{12} - \bar{X}$   
 d.  $\frac{b^2}{12d} + \bar{X}$

13. A steady three-dimensional flow field is described by a velocity vector as:

$$\vec{V} = (2x^2 + 3y) \vec{i} + (-2xy + 3y^2 + 3yz) \vec{j} + \left(\frac{y^2}{2} + 2xz + 9y^2z\right) \vec{k}$$

Magnitude of velocity at point (1, -2, 1) is equal to

- a. 2.5  
 b. 41.8  
 c. 62.5  
 d. 1748.25

14. Acceleration in the normal direction to a stream line is represented by (symbols have usual meanings)

a.  $\frac{\partial v_x}{\partial t} + \frac{v_x^2}{r}$

b.  $\frac{\partial v_x}{\partial t} + \frac{v_x^2}{r}$

c.  $\frac{\partial v_x}{\partial t} + \frac{\partial v_x}{\partial t}$

d.  $\frac{\partial v_x}{\partial t} + v \frac{\partial v_x}{\partial s}$

15. The stream function of a particular flow is

given by  $\psi = \frac{Q}{2\pi} \ln r$

Where  $r = \sqrt{x^2 + y^2}$  represents the radial distance from the origin (which is  $x = y = 0$ ). The velocity components for this flow in polar coordinates ( $r, \theta$ ) are

a.  $\frac{1}{r}$  and  $-\frac{Q}{2\pi r}$

b. 0 and  $\frac{Q}{2\pi r}$

c. 0 and  $-\frac{Qr}{2\pi}$

d. 0 and  $\frac{Qr}{\pi}$

Match List I (Type of settling) with List II (Description of process) and select the correct answer using the codes given below the lists:

**List I**

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

**List II**

1. Compression settling particle concentration increases during settling.
2. Zone settling particle concentration do not change during settling.
3. Flocculants settling. Particle settling velocity increases with time.
4. Discrete settling. Particle velocity remains constant.

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

17. Match List I (Unit operation of process) with List II (Sizing criterion) in respect of secondary treatment plant facilities and select the correct answer using the codes

**List I**

- A. Activate sludge

- B. Prit removal  
C. Screening  
D. Trickling filters

## List II

1. Overflow rate  
2. Hydraulic residue time  
3. Channel approach velocity  
4. Hydraulic and organic loading rate-detention time

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

18. The most commonly used adsorbent for water purification is

- a. Groundnut husk carbon  
b. Activated carbon  
c. Coconut shell carbon  
d. Neem bark carbon

19. Match List I with List II and select the correct answer using the codes given below the lists:

## List I

- A. High turbidity low alkalinity  
B. Low turbidity high alkalinity  
C. High turbidity high alkalinity  
D. Low turbidity low alkalinity

## List II

1. Small number of colloids make coagulation difficult. Sweep coagulation is more effective.  
2. Prevents formation of  $Al(OH)_3$   
3. Reduced pH makes small dosages of coagulant more effective.  
4. pH is relatively not affected when coagulation is aided

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

20. Which of the following processes can be combined to arrive at an appropriate water treatment scheme for a large city with envisaged maximum population of 5,00,000?

Maximum turbidity in the nearby river may reach 3000 NTU in monsoon season. The area for location of treatment plant is limited

1. Aeration

2. Chemical coagulation, flocculation and settling  
3. Slow sand filtration  
4. Rapid sand filtration  
5. Pressure filtration  
6. Chlorination

Select the correct answer using the codes given below:

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

21. Which of the following reactions take place when chlorine added to water containing ammonium?

1.  $NH_4^+ + HOCl \rightarrow NH_2Cl + H_2O$   
2.  $NH_4^+ + HOCl \rightarrow NHCl_2 + H_2O$   
3.  $NH_4^+ + HOCl \rightarrow NCl_3 + H_2O$   
4.  $NH_4^+ + HOCl \rightarrow NCl_4 + H_2O$

Select the correct answer using the codes given below:

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

22. Rainfall Duration-Intensity Frequency relationship for a certain area is described by the following:

$$i = \frac{30T^{0.5}}{(t + 12)^{0.5}}$$

Where  $i$  is the rainfall intensity in mm/h

$T$  is the recurrence interval in years

$t$  is the duration of rain fall in minutes

Which one of the following options represents the correct value of Ratio of Run off  $T = 25$  years to that of  $T = 1$  year from a catchments with 60 minutes time of concentration?

- a. 60  
b. 25  
c. 5  
d. 1

23. Match List I with List II and select the correct answer using the codes given below the lists:

## List I

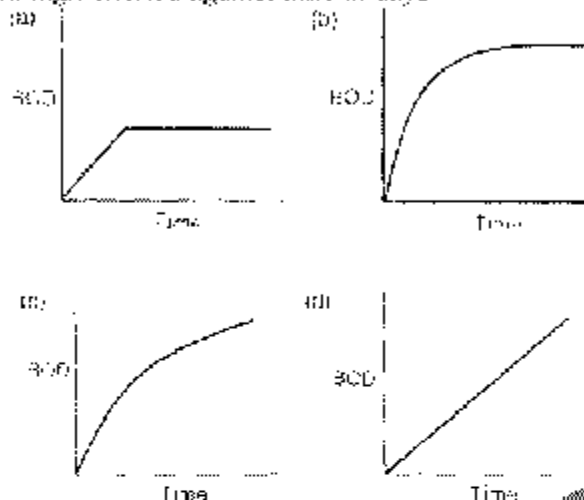
- A. Catch basin  
B. Skimming tank  
C. Siphon spillway  
D. Communitor

## List II

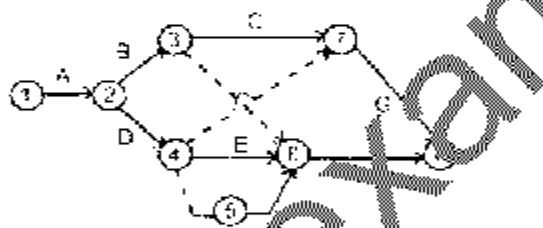
1. Floating materials
2. Inorganic solids
3. Size reduction of suspended solids
4. Excess flow

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

24. Choose the correct representation of BOD in mg/l exerted against time in days



25.



A AoA network comprising of 8 activities, with 3 dummies drawn between 8 event nodes is shown. A corresponding AoN network will have other than a dummy network node at the terminal side. K number of links between the activities represented nodes, where K will be

- a. 8

List II

26. Match List I (Information Inputs From/Into Networks) with List II (Basis) and select the correct answer using the codes given below the lists

List I

- A. Activity time
- B. WBS
- C. Floats
- D. Optimum project duration

List II

1. Contribution to project through efficient supervisory inputs
2. Scheduling facilitation
3. For small projects, direct and indirect costs of activities are considered separately.
4. Minimum total cost of each activity is considered

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

27.

Match List I (Scope of Project/Construction Activity) with List II (Aspects of Project Management Concepts to be Adopted) and select the correct answer using the codes given below the lists

List I

- A. Dredging, cleaning, maintenance, repairs and re-commissioning of water filter unit.
- B. Extension of HT system, placement of transformers and establishment of LT supply circuits for rural electrification.
- C. Establishment of Export House by a manufacturer
- D. Final phases of testing and commissioning of a power house

List II

1. Dummy arrows and timed nodes
2. Interfaces
3. ATC and PTC trade-off
4. Ladder network with interfaces
5. PERT

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

28.

Development of an optimum materials schedules for a construction job involves the following steps:

1. Scheduling of activities
2. Development of the network of activities
3. Identification of order of criticality of resources
4. Working schematic of procurement needs of materials for each job
5. A perspective view of the material and ABC classification of the material

(without losing sight of their VED and other classifications)

### 6 Supply lead time

The correct sequence in which steps given above shall be followed is:

- 3-6-1-5-4-2
- 6-5-3-2-4-1
- 2-3-5-1-6-4
- 2-1-4-3-6-5

### 29 ABC analysis is

- For choosing proper supplies
- Used for stock taking
- Basic tool for establishing economic stock levels
- Used for obtaining the lead time

### 30. Match List I (Procedure employed) with List II (Function Served) and select the correct answer using the codes given below the lists

#### List I

- Interface event
- Redundant dummy without inconsistency
- Incremental analysis

#### List II

- Indicates essentially needed external input
- Indicates optimum level of investment
- Improves clarity
- Sunk cost is eliminated
- Computes required working capital

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

### 31 The area under the distribution curve is divided into two equal halves by vertical ordinate through:

- Expected time
- Optimistic time
- Most likely time
- Pessimistic time

### 32 The SCAF for 1, 2, 3 and 4 years for a particular discrete rate of return are, respectively, 1.00, 2.045, 3.137 and 4.278 CRF for 4 years will be nearly:

- 0.34
- 0.32
- 0.30
- 0.28

### 33. When two forces A and B are mutually at right angles, their resultant is 10 kN. When

they are inclined at  $60^\circ$ , the resultant is  $5\sqrt{6}$  kN. The individual magnitudes of the forces are:

- 4 kN and 6 kN
- $\sqrt{50}$  kN and  $\sqrt{50}$  kN
- 5 kN and  $\sqrt{75}$  kN
- 6 kN and 8 kN

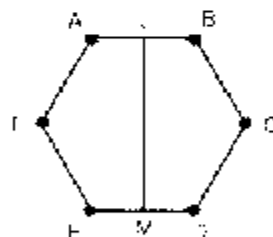
### 34 Consider the following statements with regard to equilibrium

- A body is said to be in stable equilibrium when, on receiving a slight displacement, it tends to go further away from its position of rest.
- A body is said to be in unstable equilibrium when, on receiving a slight displacement, it tends to go further away from its position of rest.
- A body is in neutral equilibrium when, on receiving a slight displacement, it tends to come to rest in its new position.

Which of the statements given above are correct?

- 1, 2 and 3
- 1 and 2
- 2 and 3
- 1 and 3

### 35.



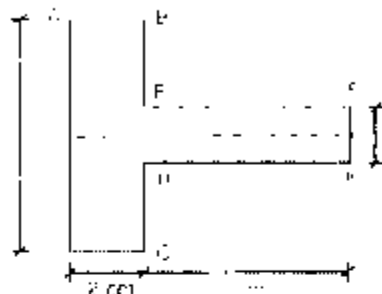
Six identical uniform rods AB, BC, CD, DE, EF and FA each weighing  $w$  are freely joined at their extremities so that they form a regular hexagon. The rod AB is fixed in horizontal position and the middle points L and M of AB and DE are connected by a weightless rod. The force induced in the connecting rod LM is

- $6w$
- $4w$
- $3w$
- $2.5w$

### 36 If a thin trapezoidal plate of larger width ' $p$ ' and smaller width ' $q$ ' and height ' $h$ ' is to hang horizontally, the point of support for its suspension shall have to

pass through the point (along the axis of symmetry)

- $\left(\frac{2p+q}{p+q}\right)\frac{h}{3}$  from the larger edge
- $h/2$  from the smaller edge
- $\left(\frac{2P+q}{P-q}\right)\frac{h}{3}$  from the smaller edge
- $h/2$  from the larger edge



In a thin uniform lamina having symmetrical central axis as shown above, the distance of centre of gravity from AD is

- 3 cm
- $22/7$  cm
- $23/7$  cm
- $24/7$  cm

The two dimensional motion of a particle is defined by the reaction  $r = 15t^2$  and  $\theta = 2t^3$  where  $r$  is expressed in meter,  $\theta$  in radians and  $t$  in seconds. The speed of the particle, m/s, at  $t = 2$ , is approximately

- 32
- 36
- 40
- 48

In the following equations  $x$  represents position and  $t$  time. Which equation represents uniformly accelerated motion?

- $x = 10 - 6t^2 - 8t - 10$
- $x = t^2 - 4t - 9$
- $x = 10t - 12$
- $x = t^2 - 10t^3 + 6$

A man of 60 kg mass walks in a boat for a distance of 2 m and stops. If friction between boat and water he neglected, the boat of mass 300 kg will move backward through a distance of

- 2m
- Zero
- $1/3$  m
- $2/5$  m

A 80 N body moving to the right at a speed of 3 m/s strikes a 10 N body moving to the left at a speed of 10 m/s. The final velocity of 10 N body is 4 m/s to the right. Then the final velocity of 80 N body will be

- 1.25 m/s
- 3 m/s
- 4 m/s
- 10 m/s

Which one of the following statements is correct in case of sphere rotating about a diameter?

- The particles on the surface of the sphere do not have any linear acceleration
- Different particles on the surface of the sphere have different angular speeds
- All the particles on the surface of the sphere have same linear speed
- The particles on the diameter mentioned above do not have any linear acceleration

Two vertical rods, one of steel and the other of copper, with cross-sectional areas 500 mm<sup>2</sup> and 1000 mm<sup>2</sup> respectively, are each rigidly fixed at the top ends at 500 mm apart. A cross bar fixed at the lower ends of the rods carries a load of 5000 N such that the cross bar remains horizontal even after loading. Take the ratio between young's modulus of the materials,  $E_s/E_c = 2$ . the load carried by the copper bar is

- 1667 N
- 4000 N
- 2500 N
- 3333 N

Which one of the following statements is not correct?

- Flexibility matrix is a square matrix
- Flexibility matrix is a symmetric matrix
- All elements of flexibility matrix must be positive
- Elements of flexibility matrix are displacements and can be computed only for the stable structures

A rectangular block is subjected to shear stress intensity of  $\tau$ . The stresses induced on a plane inclined at 135° to the horizontal axis shall be

- $\sigma_n = +\tau$  (Tensile)
- $\sigma_n = -\tau$  (compression)

c.  $\sigma_{\text{longitudinal}} = 1\tau$

d.  $\sigma_{\text{longitudinal}} = 0$

46. A cantilever beam is loaded with a uniformly distributed load of intensity  $w$  along its entire length. The span of the beam is  $L$ . Which of the following Mohr's circle diagrams correctly represent (S) the state of stress above the natural axis of the beam?

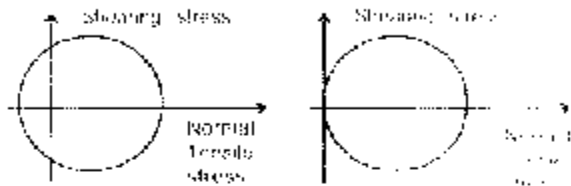


Fig. (i)

Fig. (ii)

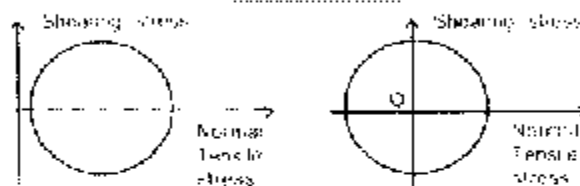


Fig. (iii)

Fig. (iv)

Select the correct answer from the codes given below:

- a. Figure (i)  
b. Figure (iii)  
c. Figure (ii) and (iv)  
d. Figure (iii) and (iv)

47.



**Note:** 'p' is the internal fluid pressure

A thin cylindrical shell is subjected to the loads as shown in figure. The element marked 'A' will be subjected to:

- a. Biaxial compressive stresses  
b. Biaxial tensile stresses  
c. Uniaxial compressive stresses  
d. Tensile stress along the longitudinal direction only

48. The time by which a particular activity can be delayed without affecting its preceding and succeeding activities is known as:
- a. Total float  
b. Free float  
c. Independent float  
d. Interfering float

49. One of the main disadvantages of the bar charts in project analysis is that:

- a. Progress of the work cannot be monitored  
b. They do not show the independences of the activities  
c. The time schedule is not shown properly  
d. The financial aspect is not shown

50. Requirement of a certain material resource during the 3<sup>rd</sup>, 4<sup>th</sup> and 5<sup>th</sup> months of a construction project is 50, 40 and 30 units respectively. It is intended that 20 percent will be purchased 2 months in advance, 50 percent one month of the order and. The maximum inventory for this material resource will be

- a. 38 units  
b. 40 units  
c. 43 units  
d. 50 units

Scheduling helps in

- a. Planning for the project  
b. Financial control of the project  
c. Preparing the estimate for the project  
d. Carrying out the project in an orderly and effective manner

To develop a cost histogram for a project, several steps involved include

1. Float utilized at start of each activity
2. Demand distribution of resource around each activity through assigned duration
3. Development of network of activities
4. WBS
5. Distribution of indirect and overhead costs

The correct sequence in which these have to be worked out is:

- a. 2-5-3-1-4  
b. 5-3-2-4-1  
c. 4-3-1-2-5  
d. 3-2-4-1-5

53. A rectangular channel carries uniform flow with a normal depth of 0.6 m and Froude number of 2.0. For this flow the critical depth is

- a.  $0.6 \times (2)^{2/3}$  m  
b.  $0.6^2 \times (2)^{1/3}$  m  
c.  $0.6^{1/3} \times (2)$  m  
d.  $0.6 \times (2)^{2/3}$  m

54. Match List I with List II and select the correct answer using the codes given below the lists

## List I

- A. Flow development length in pipes when flow is laminar  
 B. For  $Re < 2000$  in laminar flow through pipes  
 C. For  $Re$  between 3000 and 100000 in turbulent flow through pipes of smooth boundary

## List II

1. Friction factor varies linearly with Reynolds number  
 2.  $0.06 Re^{-1} D$  ( $D$  is diameter of pipe)  
 3. Friction factor varies inversely with  $Re^{1/4}$

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

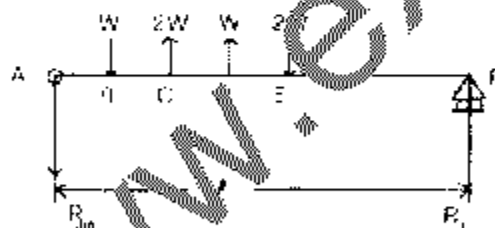
55. The velocity profile for a turbulent layer is given by:

$$u_x/U = (y/\delta)^{1/4} \text{ for } y \leq \delta.$$

The shape factor for this turbulent boundary layer shall be

- a. 7/9  
 b. 9/7  
 c. 7/8  
 d. 7/72

56.



$$AB = AC + CD + DE + EB = 0.2l$$

Assertion (A): In the beam shown the reactions  $R_1$  &  $R_2$  each of numerically equal to  $\frac{0.4l(2W + W)}{l}$  form an anti-

clockwise couple.

Reason (R): For the application of couple in the clockwise direction, the support reactions form equal and opposite couple

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

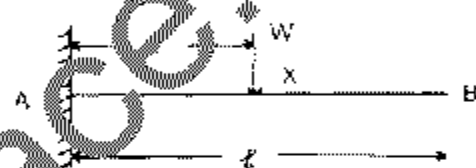
57.

Assertion (A): To a cantilever beam of circular cross-section, if a moment is applied with its axis perpendicular to the axis of beam, no shear stress will be induced in the beam.

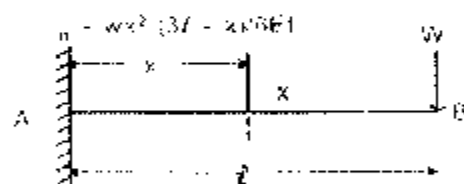
Reason (R): To the above beam, if moment is applied with its axis along the axis of the beam, no bending stress will be induced in the beam.

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

58.



Assertion (A): For the cantilever shown, the free end deflection for any position of load distance 'x' from the fixed end is as under:



Reason (R): For the beam shown, the deflection at any section distance 'x' from the fixed end is as under:

$$\delta_x = wx^3(3l - x)/6EI$$

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

59.

Assertion (A): The aggregate physical properties in coarse grained soil are a function of relative density and particle shape

Reason (R): Single grained structure is formed when the soil grains settle out independently due to mass derived forces

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



- b. Both A and R are individually 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

60. Assertion (A): Terzaghi considers in his theory of consolidation only primary consolidation, any neglects secondary consolidation.

Reason (R): Secondary consolidation begins after the end of primary consolidation.

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

61. Assertion (A): The sight distance available on road to a driver at any instant depends on the height of the driver's eye above the road surface and also on the height of the object above the road surface.

Reason (R): The sight distance available on a summit curve is that distance measured along the road surface at which an object of height 0.35 m can be seen by a driver whose eye is at a height of 1.20 m from the road surface.

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

62. Assertion (A): When a cylinder is placed in a rectilinear flow with its axis perpendicular to flow, no drag force is exerted in an ideal fluid flow.

Reason (R): The flow net and hence pressure distribution is symmetrical about a vertical plane perpendicular to the flow.

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

63. Assertion (A): It is impossible to study ship resistance by simulation in a hydraulic model.

Reason (R): In resistance study, Reynolds model law is important. But it is practically impossible to test the model

corresponding to prototype Reynolds number.

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

64. Assertion (A): The buckling load obtained by the use of Euler's formula may be much more than the actual buckling load.

Reason (R): Euler's formula does not take into account the effect of direct compressive stress.

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

65. A barrage is constructed on homogeneous pervious foundation. The difference in head between upstream and downstream water levels is 5 m of water. The flow net for seepage flow through the foundation has eleven equipotential lines including the upstream and downstream sections. The uplift pressure after the 7<sup>th</sup> equipotential line is

- a. 35:11 m
- b. 3 m
- c. 2 m
- d. 10:11 m

66. Superposition of circulation of strength  $\tau$  on uniform flow of velocity U, normal to a circular cylinder of radius a, produces a surface velocity ( $V_s$ ) as

- a.  $2U \sin \theta + \frac{\tau a}{2\tau}$
- b.  $2U \sin \theta - \frac{\tau a}{2\pi}$
- c.  $2U \sin \theta + \frac{\tau}{2\pi a}$
- d.  $2U \sin \theta - \frac{\tau}{2\pi a}$

67. If the velocity profile for a laminar boundary layer is described by

$$\frac{u}{U_0} = \sin\left(\frac{\pi y}{2\delta}\right)$$

The momentum correction factor for this velocity profile is

- a. 1.12

- b. 0.9  
c. 1.6  
d.  $\pi^2/8$

68. Match List I (Flow Problems) with List II (Equations) and select the correct answer using the codes given below

List I

- A. Open channel surface curves computations  
B. Flow through a lawn sprinkler  
C. Velocity determination in a river by profile surveying  
D. Flow analysis at the toe of a spill way

List II

1. Continuity equation  
2. Energy equation  
3. Control volume and momentum equation  
4. Control volume and moment of momentum equation

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

69. A 75 mm diameter pipe of 500 m length operates under a head of 60 m at its inlet. If a nozzle is fitted at its outlet, then for most efficient conditions the velocity of flow from the nozzle (with  $C_v = 1$ ) may be

- a. 19.8 m/s  
b. 28 m/s  
c. 10 m/s  
d. 40 m/s

70. A hemispherical tank of radius  $R$  has an orifice of cross-sectional area  $a$  at the bottom and is full of liquid. The time required to empty the tank completely is given by

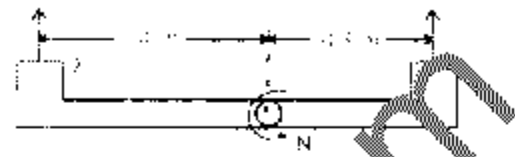
- a.  $\frac{4}{5} \frac{\pi R^3}{C_d a \sqrt{2g}}$   
b.  $\frac{1}{15} \frac{\pi R^3}{C_d a \sqrt{2g}}$   
c.  $\frac{14}{15} \frac{\pi R^3}{C_d a \sqrt{2g}}$   
d.  $\frac{16}{21} \frac{\pi R^3}{C_d a \sqrt{2g}}$

71. A jet of water of cross-sectional area  $-0.015 \text{ m}^2$  and velocity  $15 \text{ m/s}$  impinges normally on a plate moving with a velocity of  $5 \text{ m/s}$  in the direction of the jet. The

force on the plate is (mass density of water  $= 1000 \text{ kg/m}^3$ )

- a. 750 N  
b. 1500 N  
c. 2250 N  
d. 3375 N

72



A sprinkler with unequal arms having jets of area  $0.8 \text{ cm}^2$  at each end and facing same direction receives a total flow of  $1.5 \text{ liters/s}$  at the axis. Absolute velocity of water discharging at the end of longer arm at X, when the sprinkler is rotating at  $36 \text{ rpm}$ , will be approximately

- a. 9.4 m/s  
b. 5.8 m/s  
c. 6 m/s  
d. 10.9 m/s

73

A fan operating at  $n = 1800 \text{ rpm}$  and a volume flow rate of  $4.5 \text{ m}^3/\text{s}$  develops a head of  $15 \text{ cm}$ , measured on a U-tube manometer filled with water. For a geometrically similar fan that will produce the same head at the same efficiency, but at a speed of  $n = 1200 \text{ rpm}$ , the flow rate will be

- a.  $10.12 \text{ m}^3/\text{s}$   
b.  $6.75 \text{ m}^3/\text{s}$   
c.  $15.18 \text{ m}^3/\text{s}$   
d.  $8.27 \text{ m}^3/\text{s}$

74

For a real fluid flow along a long and thin flat plate consider the following observations about the boundary layer growth

1. Thickness of boundary layer increases along the direction of flow.
2. Boundary shear stress increases along the direction of flow
3. Flow within the boundary layer is laminar near the plate surface and turbulent away from it.
4. Space beyond boundary layer has constant velocity and zero shear stress.

Which of the observations given above are always correct?

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

75. A small plastic sphere is allowed to freely fall in a viscous liquid in a wide jar. Which of the following statements are correct for this case?

1. Terminal velocity is maximum velocity the sphere attains as it falls
2. Terminal velocity is the average velocity of the sphere just before it touches the bottom of the jar
3. The sphere is acted by form drag
4. Drag coefficient of the sphere =  $24/\text{Reynolds number}$

Select the correct answer using the codes given below:

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

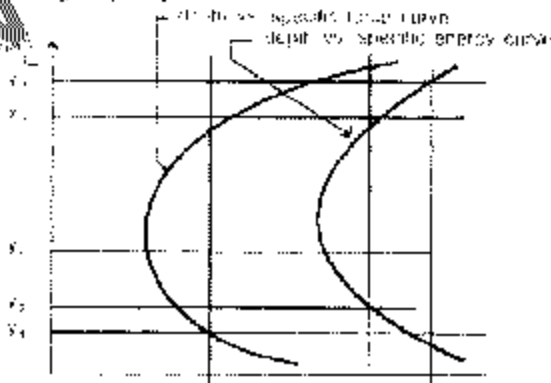
76. In a pipe flow problem, Reynolds number =  $10^5$ , Darcy's  $f = 0.0144$ , pipe radius =  $0.1 \text{ m}$ , average height of roughness =  $0.05 \text{ mm}$ . The flow in the pipeline is

- a. Laminar
- b. Smooth turbulent flow (STF)
- c. Rough turbulent flow (RTF)
- d. Transition from STF to RTF

77. A 300 mm diameter pipe of mild steel having 6 mm thickness carries water with a velocity of 3 m/s. What will be the strain in pressure if the valve at the downstream is closed instantaneously? (E = Volume modulus of elasticity of water =  $2 \times 10^6 \text{ N/m}^2$ ,  $\rho = 1000 \text{ kg/m}^3$ )

- a.  $2424 \text{ kN/m}^2$
- b.  $4141 \text{ kN/m}^2$
- c.  $4242 \text{ kN/m}^2$
- d.  $4441 \text{ RN/m}^2$

78. For a given discharge in a prismatic channel, specific force and specific energy curves have been drawn (see figure). The hydraulic jump can take place with pre- and post-jump depth as



- a.  $y_1$  and  $y_2$
- b.  $y_1$  and  $y_4$
- c.  $y_3$  and  $y_1$
- d.  $y_2$  and  $y_4$

79. It has been observed for critical depth  $y_{cr}$  in a rectangular channel carrying a constant discharge that

1. Specific energy is maximum
2. Froude number = 1.0
3. Specific energy =  $1.33 y_{cr}$
4. Specific force is minimum

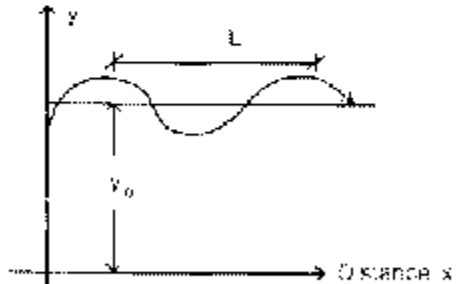
Which of the above observations are correct?

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

80. Which one of the following statements is not correct?

- a. In hydrodynamic ally smooth boundaries the thickness of laminar sub-layer is less than roughness projections.
- b. For hydrodynamic ally smooth boundary friction factor 'f' depends only on Reynolds number
- c. For boundaries in transitional region friction factor 'f' is a function of relative roughness and Reynolds Number
- d. In hydrodynamic ally rough boundary friction is solely dependent upon the relative roughness

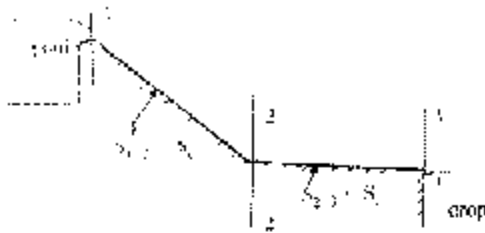
81



Neglecting viscosity and surface tension, celerity of a small amplitude wave as shown in the figure above, is given by

- a.  $C = \sqrt{\frac{gI}{\pi} \tanh \frac{2\pi y_0}{L}}$
- b.  $C = \sqrt{\frac{gI}{2\pi} \tanh \frac{2\pi y_0}{L}}$
- c.  $C = \sqrt{\frac{gI}{2\pi} \tanh \frac{\pi y_0}{L}}$

$$d. C = \frac{2gL}{\pi} \sqrt{\tan h \frac{\pi y_0}{2L}}$$



A prismatic channel is laid (see figure) with a break in bottom slope, as shown at section 2-2, so that water flows from a crest (section 1-1), in the channel to discharge over a sudden drop (section 3-3). The surface profiles along the flow along 1 to 2 to 3 will be

- S2, M3, HJ, M2
- S2, HJ, M1, M2
- M2, M1, HJ, S2
- M2, HJ, M1, S2

83. The specific gravity of sea-water is around 1.025 and that of fresh water is 1.0. At a particular place along the coast, fresh ground-water exists 1.0 m above the sea level.

Which one of the following depths below sea level represents the existence of this ground water interface with sea water?

- 0.4 m
- 4.0 m
- 40.0 m
- 400.0 m

84. Match List I (Element of Impurity) with List II (Disease) and select the correct answer using the codes.

**List I**

- Nitrates
- Fluorides
- Virus
- Bacteria

**List II**

- Cholera
- Blue Babies
- Embrittlement of Bones
- Infectious Hepatitis

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

85. Match List I with List II and select the correct answers using the codes given below:

**List I (Bacteria)**

- Cocci
- Vibro
- Bacilli
- Spirillum

**List II (Shape)**

- Comma shape
- Rhombus shape
- Helical shape
- Rod shape
- Round shape

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

86. Quality parameters of rain water from different sources are given below:

Source	Quality parameters			
	Turbidity (NTU)	TDS (mg/l)	Chlorides (mg/l)	Fluorides (mg/l)
A	0.5	500	100	15
B	0.2	1000	200	15
C	8.0	1400	250	10
D	7.0	1600	300	0.4

Water drawn from which of the above sources can be tolerated for drinking without any treatment?

- A and B
- B and C
- C only
- D only

87. Match List I (Characteristic of Intake) with List II (Type of Intake) and select the correct answer using the codes given below:

**List I**

- This is the form of a crib with screened bell mouth
- This is also called gate house or valve tower
- Pen stocks are located at different leaves
- Wet wells should be provided each with a blow-off-valve

**List II**

- Intake well
- Lake intake
- Exposed intake
- Submerged intake
- Canal intake

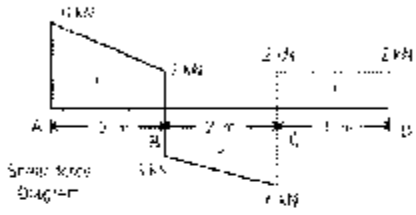
A B www.examrace.com

- a. 4 1 5 2
- b. 2 3 1 4
- c. 4 3 1 2
- d. 2 1 5 4

88. In a city with a population of 70,000, water is drawn for domestic purposes from a bell-mouth intake in a canal which runs only for 10 hours a day with a flow depth of 1.5. if the average consumption per person is 150/lpd, then the intake load is

- a. 0.30 m<sup>3</sup>/s
- b. 0.29 m<sup>3</sup>/s
- c. 0.27 m<sup>3</sup>/s
- d. 0.23 m<sup>3</sup>/s

89.



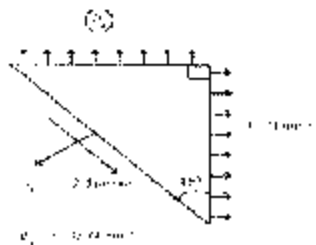
Consider the following statements in regard to the shear force diagram for an overhanging beam supported at A and C:

1. The beam is carrying a uniformly distributed load of 2kN/m through.
2. The beam is carrying a uniformly distributed load of 2kN/m over the supported span AC and concentrated load of 2 kN at the free end B.
3. The beam is carrying a uniformly distributed load of 2 kN/m over the supported span AC, and concentrated load of 5 kN at the free end of supported span BC and also a point load of 2 kN at the free end.
4. The point of contra flexure occurs between the supported region AC and nearer to support C.

Which of the above statements is/are correct?

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

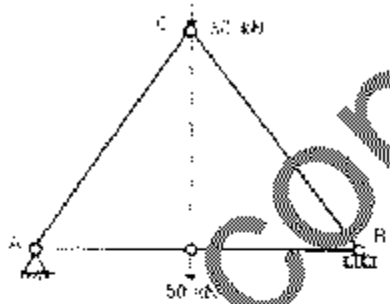
90.



For the two-dimensional stresses shown in the figure, what is the normal stress on the 45° plane?

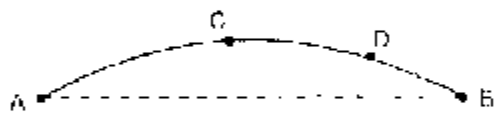
- a. 20 N/mm<sup>2</sup>
- b. 12 N/mm<sup>2</sup>
- c. 4 N/mm<sup>2</sup>
- d. 8 N/mm<sup>2</sup>

91.

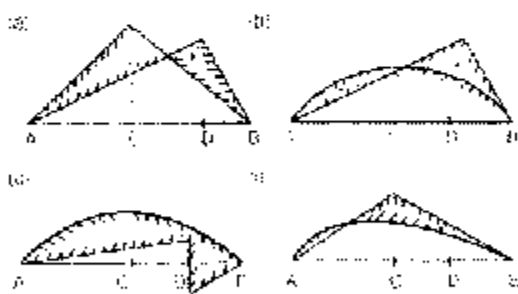


The force induced in the vertical member CD of the symmetrical plane truss shown in the figure is

- a. 50 kN (tension)
- b. 100 kN (tension)
- c. 50 kN (compression)
- d. zero



Shape of influence line diagram for bending moment at D in a symmetrical two hinged arch given above is

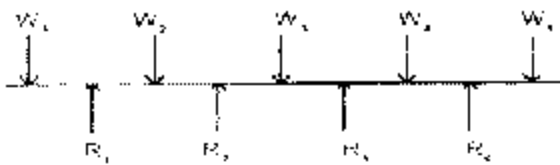


93.

A horizontal fixed beam AB of span 6 m has uniform flexural rigidity of 4200 kN m<sup>2</sup>. During loading, the support B sinks downwards by 25 mm. The moment induced at the end A is

- a. 17.5 kN m (Anticlockwise)
- b. 17.5 kN m (Clockwise)
- c. 105 kN m (Anticlockwise)
- d. 105 kN m (Clockwise)

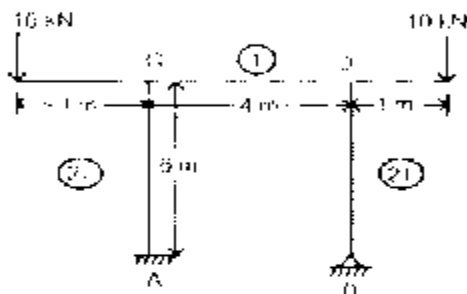
94.



The above figure shows a continuous beam with cantilevered ends. It is

- Statically determinate
- Statically indeterminate to the first degree
- Statically indeterminate to the second degree
- Statically indeterminate of the third degree

95.



The possible direction of sway of the rigid frame shown in figure

- Is towards left
- It towards right
- Does not exist as there is no sway
- Cannot be ascertained

96.

Match List I with List II and select the correct answer using the codes given below:

List I (Method)

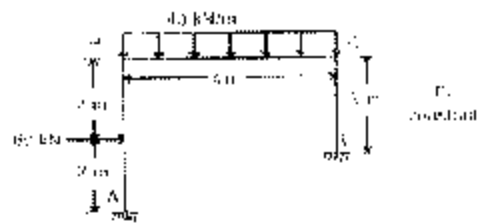
- Moment distribution method
- Slope deflection method
- Kani's method
- Force method

List II (Factors)

- Rotational factor
- Flexibility
- Hardy Cross
- Displacements
- Stiffness matrix

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

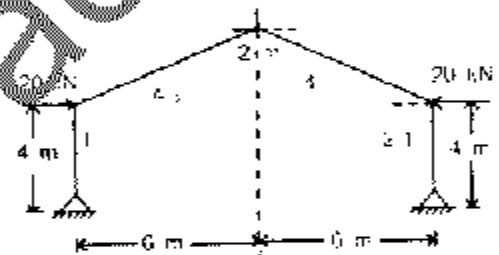
97.



The figure given above shows a rigid frame. If  $\Delta$  is lateral translation of the joints, slope deflection equation for the member BA can be written as

- $M_{BA} = -30 + \frac{2EI}{4} \left( 2\theta_B - \frac{3\Delta}{4} \right)$
- $M_{BA} = -30 - \frac{2EI}{4} \left( 2\theta_B + \frac{3\Delta}{4} \right)$
- $M_{BA} = -30 + \frac{2EI}{4} \left( 2\theta_B + \frac{3\Delta}{4} \right)$
- $M_{BA} = -30 - \frac{2EI}{4} \left( 2\theta_B + \frac{3\Delta}{4} \right)$

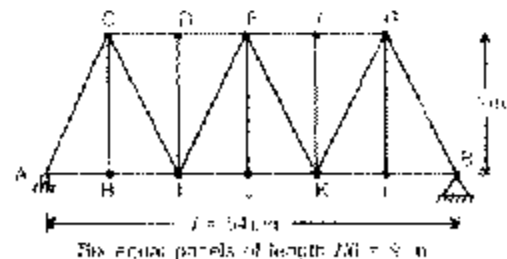
98.



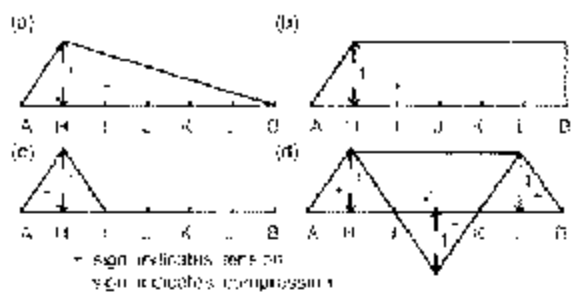
The rigid gable frame shown in figure is to be analyzed by stiffness method. The order of stiffness matrix to be inverted to obtain the solution is

- $5 \times 5$
- $7 \times 7$
- $8 \times 8$
- $2 \times 2$

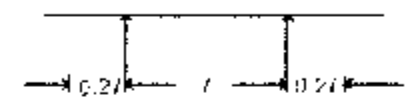
99.



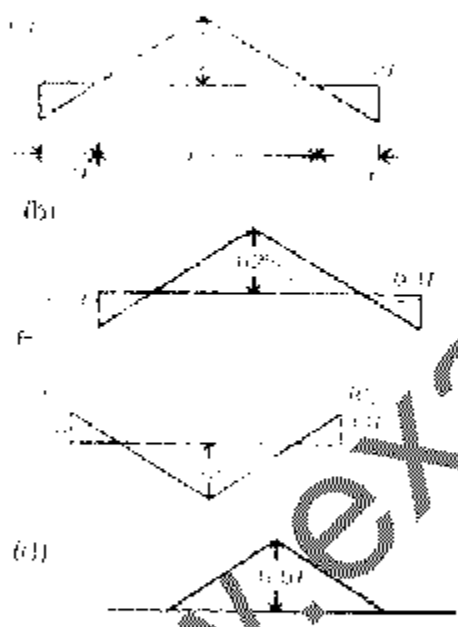
For the pin-jointed plane truss shown in the above figure, which of the following diagrams represents the influence line for the bar force in the member CH?



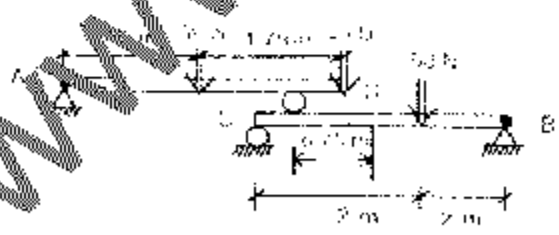
100



The above figure shows a simply supported beam with cantilevered arms. Which one of the following diagrams represents the correct influence line for bending moment at mid-span?



101



In the set of beams shown above, the reactive force at support A is  
 a. 30 N  
 b. 10 N  
 c. 20 N  
 d. 40 N

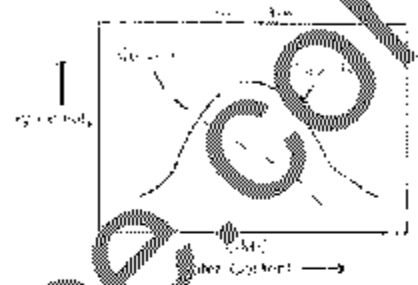
102.

Consider the following statements:  
 Capillary water in soils

1. Causes negative pore water pressure
  2. Reduces effective pressure
  3. Increases bearing capacity
  4. Reduces bearing capacity
- Which of the statements given above are correct?

- a. 1 and 3
- b. 1 and 4
- c. 2 and 3
- d. 2 and 4

103.



Curve B shows the typical compaction curve of soil in the proctor test. Dotted curve A is shown superposed on the same graph. Which one of the following compressions corresponds to the ordinate axis of curve A?

- a. Zero air voids
- b. Wet density
- c. Penetration resistance of proctor needle
- d. 95% saturation

104.

Consider the following statements:  
 To obtain an undisturbed soil sample from a bore hole in soft soils, the conditions to be satisfied are

1. A rotary sampler us to be used
2. A piston sample should he used
3. The inside clearance short d be less than 3%
4. Heavy wall sampler with brass liners

Which of the above statements are correct?

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

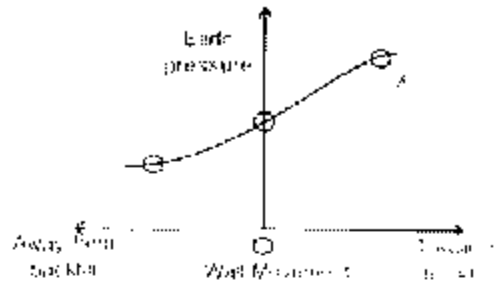
105.

A soil having  $c = 0$  and with characteristic  $\phi$  in dry condition is retained by a vertical faced retaining wall. Using Rankine's approach, the ratio of coefficient of passive earth pressure to coefficient of active earth pressure is given by

- a.  $\sqrt{\tan(45 + \phi/2)}$
- b.  $\tan(45 + \phi/2)$

- c.  $\tan^2(45 + \phi/2)$
- d.  $\tan^2(45 - \phi/2)$

106



Earth pressure and resultant possibilities of wall movement are shown in figure. The point marked 'X' in the diagram denotes:

- a. Earth pressure at rest
- b. Active Earth pressure
- c. Arching active pressure
- d. Passive Earth pressure

107

A  $C-\phi$  soil has failed in local shear. Which one of the following pairs of shear parameters must be used to evaluate the bearing pressure of the soil?

- a.  $C_u = C$  and  $\phi_u = 2/3\phi$
- b.  $C_u = 2/3 C$  and  $\phi_u = 2/3\phi$
- c.  $C_u = 2/3 C$  and  $\phi_u = \phi$
- d.  $C_u = 2/3 C$  and  $\phi_u = \tan^{-1}(2/3 \tan \phi)$

108

What will be the immediate settlement of column footing 1.5m diameter that is contracted upon an unsaturated clay layer, given that total load carried by the column is 150 kN; modulus of elasticity of the soil = 7000 kPa; Poisson's ratio = 0.25? Assume the footing to be rigid and influence factor = 0.79

- a. 13.5 mm
- b. 27 mm
- c. 54 mm
- d. 135 mm

109

Consider the following statements:  
 1. Lime stabilization of soil leads to  
 2. Decrease in shrinkage limit  
 3. Increase in plastic limit  
 4. Decrease in liquid limit  
 5. Flocculation of clay particles

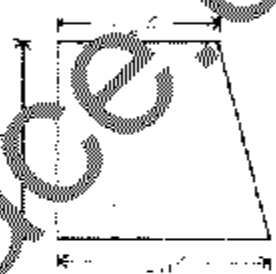
Which of the statements given above are correct?

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

110. Which one of the following is the correct requirement for base course for a mechanically stabilized road?

Maximum size	Soil Description % passing 75 microns	LL	PL
a. 40	5-15	$\leq 25$	$\leq 6$
b. 75	15-20	$\leq 30$	$\leq 10$
c. 100	20-25	$\leq 40$	$\leq 15$
d. 150	25-30	$\leq 50$	$\leq 20$

111. The figure given above shows the distribution of vertical effective stress along a depth  $z$  in a soil deposited. Which one of the following conditions of soil deposit does it represent?



- a. Completely saturated soil
- b. Completely submerged soil in the water table at ground surface
- c. Partially saturated soil by capillary action
- d. Completely saturated by capillary action water table with no flow

112. A horizontal stratified soil deposit consists of three layers each uniform in itself. The coefficients of permeability's of these layers are  $8 \times 10^{-6}$  m/s,  $50 \times 10^{-6}$  m/s and  $10 \times 10^{-6}$  m/s and their thicknesses are 6m, 4m and 10 m respectively. The effective average permeability of the deposit in the horizontal direction will be

- a.  $13.6 \times 10^{-6}$  m/s
- b.  $15.4 \times 10^{-6}$  m/s
- c.  $3.2 \times 10^{-6}$  m/s
- d.  $12.5 \times 10^{-6}$  m/s

113. Match List I (Property) with List II (Scope of curve) and select the correct answer using the codes given below

- List I**
- A. Coefficient of compressibility
  - B. Compression index
  - C. Coefficient of sub grade modulus
  - D. Coefficient of consolidation
- List II** www.examrace.com
- i. Stress void ratio



2. Log stress-void ratio				
3. Time-void ratio				
4. Stress deformation				
	A	B	C	D
a.	4	3	1	2
b.	1	2	4	3
c.	4	2	1	3
d.	1	3	4	2

114. Match List I (Roller type) with List II (Utility) and select the correct answer using the codes given below:

List I

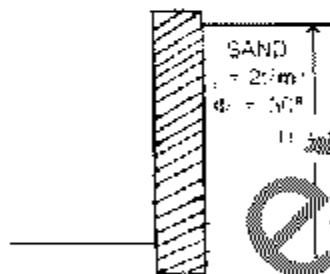
- Sheep-foot roller
- Smooth heavy roller
- Pneumatic roller
- Vibrating roller

List II

- Heating of Earth dam
- Dry sand
- Casing of earthen dam
- Gravel in WBM road

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

115.



Active earth pressure per meter length on the retaining wall with a smooth vertical back as shown in the figure will be

- 81t
- 27t
- 21t
- t

116. If  $L$  be the length of vehicle in meters,  $C$  is clear distance between two consecutive vehicles (Stopping sight distance),  $V$  is the speed of vehicles in km/hour, then the maximum number ( $N$ ) of vehicles/hour is equal to

a.  $N = \frac{1000V}{C+L}$

b.  $N = \frac{C+L}{1000V}$

c.  $N = \frac{1000V}{C-L}$

d.  $N = \frac{1000C}{L-V}$

117. Weaving length is the distance

- Equal to half the perimeter of central rotary
- Between the canalizing islands
- Equal to total width of adjoining radial roads
- Equal to diameter of central rotary

118. Match List I (Tests) with List II (Physical Properties) and select the correct answer using the codes given below:

List I

- Abrasion test
- Crushing strength test
- Impact test
- Soundness test

List II

- Durability
- Toughness
- Hardness
- Compressive strength

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

119. Which one of the following premix methods is used for base course?

- Bituminous carpet
- Mastic asphalt
- Sheet asphalt
- Bituminous bound macadam

120. Consider the corrections to be applied to the basic length of the runway

- Elevation correction
- Gradient correction
- Temperature correction

The correct order of applying the corrections to obtain runway length is

- 1-2-3
- 1-3-2
- 2-3-1
- 3-1-2