

CIVIL ENGINEERING

1. The momentum correction factor (β) is used to account for
- Change in the direction of flow
 - Change in total energy
 - Change in mass rate of flow
 - Non-uniform distribution of velocities
2. The shear velocity v_s is expressed as
- $\rho + \tau_s$
 - $\sqrt{\rho \times \tau_s}$
 - $\sqrt{\rho / \tau_s}$
 - $\sqrt{\tau_s / \rho}$
3. Match List I (Practical flow situations) with List II (Types of flow situations) and select the correct answer
- List I**
- Flow in porous strata towards tube well pipe
 - Whirling motion in a river
 - Seepage flow below foundation of irrigation work
 - Flow of fluid contained in an axially rotated vessel
- List II**
- Free vortex flow
 - Forced vortex flow
 - Radial flow
 - Neither 1, 2 nor 3
- | | A | B | C | D |
|----|---|---|---|---|
| a. | 3 | 4 | 4 | 2 |
| b. | 3 | 2 | 4 | 4 |
| c. | 1 | 1 | 2 | 4 |
| d. | 1 | 3 | 4 | 2 |
4. Match List I (Properties/characteristics to be measured) with List II (Equipment/instrument) and select the correct answer.
- List I**
- Velocity of gas flow
 - Shear
 - Density
 - Free-surface flow
- List II**
- Parshall flume
 - Pycnometer
 - Hot wire anemometer
 - Dynamometer
- | | A | B | C | D |
|----|---|---|---|---|
| a. | 1 | 4 | 2 | 3 |
| b. | 3 | 4 | 2 | 3 |
| c. | 1 | 2 | 4 | 3 |
| d. | 3 | 2 | 4 | 1 |
5. Which of the following pairs is correctly matched?
- Froude's number : Inertial to surface tension force
 - Mach number : Inertial to elastic force
 - Euler number : Inertial to gravity force
 - Rayleigh number : Inertial to pressure force
6. A spillway model constructed to a scale of 1/4 gives a discharge of 5 m³/s. The discharge from the prototype would be
- 160m³/s
 - 640m³/s
 - 10m³/s
 - 20m³/s
7. A river model is made to a length scale ratio of 1/100 and depth scale ratio of 1/16. A peak discharge of 25,600 m³/s in the river will be simulated in the model with a discharge of
- 10 cumec.
 - 4 cumec.
 - 1.6 cumec.
 - 0.64 cumec.
8. Along a surface with adverse pressure gradient, the point of boundary layer separation is characterized by
- $[\partial u / \partial y]_{y=0} = 0$
 - Shear stress at surface is maximum
 - Air and other dissolved gases in water start appearing a tiny cavities
 - Fluid layer adjacent to surface has velocity equal to free stream velocity
9. The drag force experienced by an object is

- a. The vertical component of the resultant fluid dynamic force acting on the object
- b. The horizontal force due to pressure variation over the surface of the object
- c. The component of the resultant fluid dynamic force in the flow direction
- d. The resultant fluid dynamic force acting on the object

10. Consider the following statements:
- 1. Water hammer can develop in an unsteady flow only
 - 2. Time required for rapid closure of valve is between $2 L/C$ and $4 L/C$ where L is the pipe length and C is the celerity of wave
 - 3. In flexible water column theory, pipe may expand and water may compress in the flow system
 - 4. Joukowski has carried out the mathematical analysis of water hammer

Which of the above statements relating to water hammer in pipes are correct?

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

11. Match List I (Practical case) with List II (Type of flow) and select the correct answer:

List I

- A. Canal flow
- B. River flow in alluvial reach during rising flood
- C. Flow in river upstream of a weir during winter season
- D. Flow downstream of an overflow spillway

List II

- 1. Steady and non-uniform (Gradually varied) flow
- 2. Steady and non-uniform (Rapidly varied) flow
- 3. Steady uniform flow
- 4. Unsteady and non-uniform (Gradually varied) flow

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

- c. 3 2 1 4
- d. 1 4 3 2

12. A rectangular channel of 2.5 m width and 2m depth of water carries a flow of $10 \text{ m}^3/\text{s}$. The specific energy for the flow is given by
- a. 1.18 m
 - b. 3.4 m/s
 - c. 2.0 m/s
 - d. 2.2m

13. Water flows in a channel of a Froude number greater than 1. If the channel is contracted, then in the contracted section
- a. Both y and v increase
 - b. Both y and v decrease
 - c. y increases and v decreases
 - d. y decreases and v increases

14.



A prismatic channel is laid out as shown above with two stretches, one with slope less than critical followed by another stretch with slope more than critical. At the end of second stretch is built a weir of considerable height across the flow. The type of flow profiles along the direction of flow will be

- a. S_1, M_2 then M_1
- b. M_2, S_2 then S_1
- c. S_2, M_2 then C_1
- d. M_1, S_2 then S_1

15. The head over a 90° V-notch weir increases from 0.15 m to 0.3m. The ratio of new discharge to the original discharge is nearly equal to
- a. 5.65
 - b. 1.42
 - c. 4.0
 - d. 2.62

16. Rainfall mass curve shows the variations of
- a. Rainfall intensity with time
 - b. Rainfall intensity with cumulative rainfall
 - c. Rainfall excess with time
 - d. Cumulative rainfall with time

17. Guide banks are provided to
- Train the flow of a river along a specified course
 - Reduce the peak flood discharge
 - Confine the width of river
 - Increase the water way

18. In the most efficient trapezoidal section, which of the following is NOT true?

- The top width is twice the length of sloping side
- The hydraulic mean depth is half the depth of flow
- The shape is half of regular hexagon
- The depth must be equal to top width

19. The purpose of a cross regulator in irrigating canals is

- To control the discharge into the off-take canal
- To maintain proper levels in the main canal
- To control the silt entry into the off-take canal
- None of the above

20. The percentage of oxygen in Seawater as compared to Fresh River water is

- 1.0% less of oxygen
- 20% less of oxygen
- 2.0% more of oxygen
- 20% more of oxygen

21. Iron and Manganese can be removed from water by

- Boiling
- Aeration followed by coagulation
- Chlorination
- Activated carbon treatment

22. Stratification of water with depth in reservoir (with free surface) is based on temperature. The dark stagnant cooler water layer is known as

- Thermocline
- Hypolimnion
- Metolimnion
- Boundary

23. An ideal settling basin is designed with surface overflow rate (SOR) of $1\text{ m}^3/\text{m}^2\text{h}$. Particles have their discrete settling velocities and concentration as follows

Particle type	Settling velocity (m/h)	Initial concentration (mg/l)
1.	1.0	100
2.	0.5	100
3.	0.1	100
4.	0.05	100

Which one of the following gives correct estimate of the overall removal of particles per hour?

- 65 mg/l
- 165 mg/l
- 265 mg/l
- 365 mg/l

24. Consider the following characteristics:

- Effective size 0.5 mm
- Uniformity coefficient : 2.5
- Porosity : $5.0\text{ m}^3/\text{m}^2/\text{h}$

Which of the above values are correct in respect of rapid sand filter?

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

25.

Two reservoirs are connected by a pipeline consisting of two pipes A and B with equal friction factor and length, and connected in series. If the diameter of pipe A is 20% larger than that of pipe B, the ratio of head loss in pipe A to that of pipe B is, nearly

- 0.40
- 0.53
- 0.60
- 0.83

26.

The industrial process that generates industrial waste water containing chromium is

- Food processing
- Tannery
- Porteries
- Soap manufacturing

27.

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

List I

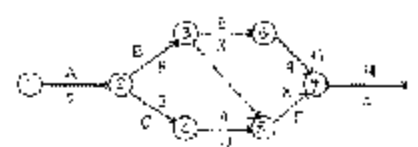
- Anti-siphon age
- Benching
- Invert
- Vent pipe

List II

- 1. Protects trap seal from backflow
- 2. Has sloped floor in inspection chamber
- 3. Preserves the water seal in traps
- 4. The lowest point

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

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The flownet of activities of a project is shown in the above figure. The duration of the activities are written along the arrows. The critical path of the activities is along

- a. 1-2-4-5-7-8
- b. 1-2-3-5-7-8
- c. 1-2-3-6-7-8
- d. 1-2-4-5-6-7-8

35

Consider the following statements

- 1. A project has a mission
- 2. A project has to terminate at some time or the other
- 3. Projects vary in terms of technology, equipment and materials, machinery and people, work ethics and organizational culture

Amongst the above, the characteristic features for a project are

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

36

In a project logic, four activities M, N, O and P are required to be completed before starting activity Q. If the finish times of M, N, O and P are 12 days, 14 days, 15 days and 17 days respectively, the earliest event occurrence time for the activity Q is

- a. 12 days
- b. 14 days
- c. 15 days
- d. 17 days

37

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

- List I**
- A. PERT
 - B. Node
 - C. Dummy
 - D. CPM

- List II**
- 1. Activity based

28. Electrostatic precipitator is a device to control

- a. SO₂ emission
- b. Particulate emission
- c. Both SO₂ and particulate emission
- d. Precipitation of Al(OH)₃ in water coagulation

29. The following data pertain to a waste-water sample:

Initial D.O. = 8mg/l
 Final D.O. = 2mg/l
 Dilution = 1%
 The B.O.D. of the given wastewater sample is

- a. 600 mg/l
- b. 6mg/l
- c. 0.6 mg/l
- d. 1 mg/l

30. Which of the following pollutant is responsible for depletion of ozone layer?

- a. Un burnt hydrocarbon
- b. UV rays
- c. Chlorofluoro carbons
- d. Oxides of nitrogen

31. The odor of a yellow paint or varnish is derived from which of the following chemical compounds?

- a. Organic bases
- b. Volatile organic compounds
- c. Ethylene
- d. Acetylene

32. Allowable disposable rate of application of sludge on land is determined by

- a. Carbon content of sludge
- b. Nitrogen content of sludge
- c. Phosphorus content of sludge
- d. Potassium content of sludge

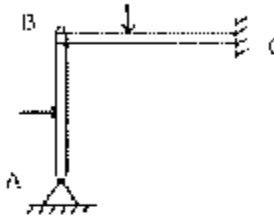
33. Unit cost of any item of work can be found by using

- a. Specifications

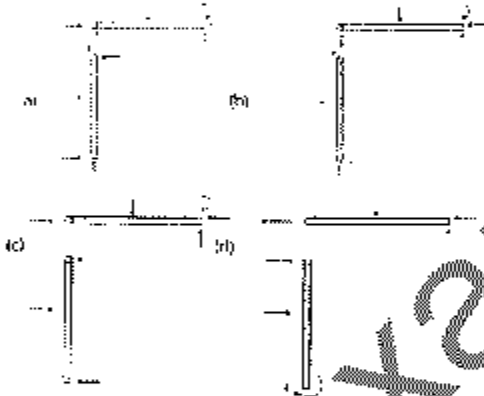
2. Imaginary activity
3. End of job
4. Event oriented

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

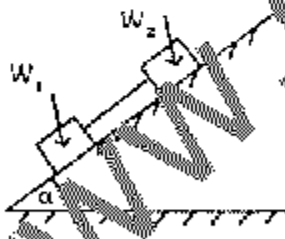
38.



Select the correct free body diagram for the structure shown in the figure given above. The structure is hinged at A and B while C is fixed.



39.



The figure given above shows two blocks of equal weights designated as W_1 and W_2 connected together by a rod and resting on an inclined plane whose angle α can be varied. The coefficients of friction between the blocks and the surface of the plane are $\mu_1 = 0.2$ and $\mu_2 = 0.3$. The value of angle α at which the slipping will commence is given by

- a. $\tan \alpha = 0.1$
- b. $\tan \alpha = 0.2$
- c. $\tan \alpha = 0.25$

d. $\tan \alpha = 0.8$

40. Two men, one stronger than the other have to lift a load of 1200 N which is suspended from a light rod of length 3 m. The load is suspended between the two persons positioned at the two ends of the rod. The weaker of the two persons can carry a load up to 400 N only. The distance of the load to be suspended from the stronger person such that the weaker person has the full share of 400 N is

- a. 0.5 m
- b. 1.0 m
- c. 1.5 m
- d. 2.0 m

41. A particle starting at time $t = 0$, moves a distance given by $x = t(1 - e^{-t})$ in time t along a straight track. Consider the following statements:

1. Velocity of the particle when a long period of time has elapsed, is one unit
2. Acceleration of the particle when a long period of time has elapsed, is zero
3. Velocity of the particle increases with time

Which of these statements is/are correct?

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

42. Two blocks of masses m_1 and m_2 ($m_1 > m_2$) are connected by an inextensible string passing over a smooth pulley. If the acceleration of m_1 is $g/5$ downwards, then $m_1 : m_2$ is

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

43. If m_1, m_2, m_3, \dots are the masses of very small portions of a body and x_1, x_2, x_3, \dots are their distances from a fixed straight line, the radius of gyration of the body about the given straight line is given by

- a. $\sum mx$
- b. $(\sum mx^2 / \sum m)^{1/2}$

c. $\sum mx^{-1} / \sum mx$

d. $\sum m^2 x / \sum mx$

44. For perfectly elastic bodies, the value of coefficient of restitution is

- a. 1.0
- b. 0.5
- c. 1.0
- d. Infinite

45. A vehicle is moving up an incline when the driver applies its brakes and the vehicle retards at 0.5 m/s^2 . Then according to D'Alembert's principle

- a. Inertia force will be directed in the direction of motion
- b. Inertia force will be directed opposite to the direction of motion
- c. Magnitude of the inertia force will depend on the angle of inclination
- d. Magnitude of the inertia force will depend on coefficient of friction between the wheels and the road surface

46. A girl is swinging on a swing in sitting position. When she stands up of the swing, the period of swing

- a. Will increase
- b. Will decrease
- c. Will remain the same
- d. Will increase or decrease depending on the height of the girl

47. The axial load which just produces the condition of elastic instability in a column is

- a. Rankine load
- b. Euler load
- c. Yield load
- d. Fatigue load

48. The phenomenon of decreased resistance of a material due to reversal of stress is called

- a. Resilience
- b. Elasticity
- c. Creep
- d. Fatigue

49. The maximum shear stress occurs on

- a. Principal planes
- b. Planes at 45° to the principal planes
- c. Planes at 90° to the principal planes

d. Planes independent of the inclination to the principal planes

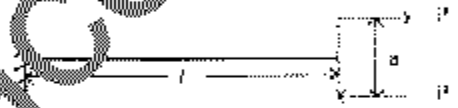
50. Total elongation of a prismatic bar of length L , weight W , cross-sectional area A and modulus of elasticity E , under its own weight, while hanging vertically, is

- a. WL/AE
- b. $2WL/AE$
- c. $WL/2AE$
- d. $WL/3AE$

51. The ratio of the maximum shear stress to the difference of the two principal stresses is

- a. 1/2
- b. 1/3
- c. 1/4
- d. 1/6

52.



A cantilever is loaded as shown in the above figure. The bending moment along the length is

- a. Uniform
- b. Uniformly varying
- c. Zero
- d. Concentrated at the free end

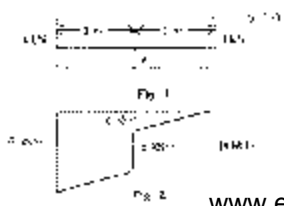
53. Consider the following statements

1. Point of contra flexure is the point where the bending moment is maximum
2. Point of contra flexure is the point where the bending moment changes sign
3. Point of contra flexure is the point where the shear force is zero

Which of these statements is/are correct?

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

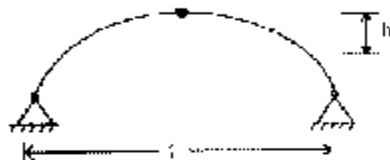
54.



The S.R.D. and B.M.D. for a beam are shown in Fig. 1 and Fig. 2. The corresponding loading diagram is



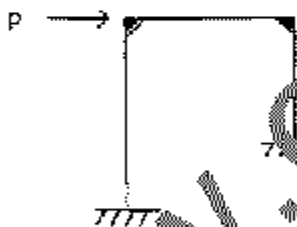
55.



A three hinged arch is shown in the above figure. The influence line for the horizontal reaction is



56.



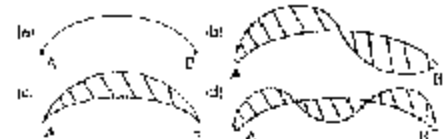
The portal frame shown in the above figure is statically indeterminate to the

- First degree
- Second degree
- Third degree
- None of the above

57.



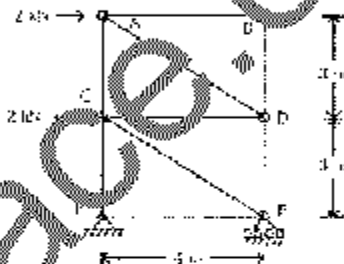
For the two-hinged parabolic arch as shown in the above figure, which one of the following diagrams represents the shape of the bending moment variation?



58. A perfect plane frame having n number of members and j number of joints should satisfy the reaction

- $n < (2j - 3)$
- $n = (2j - 3)$
- $n > (2j - 3)$
- $n = (3 - 2j)$

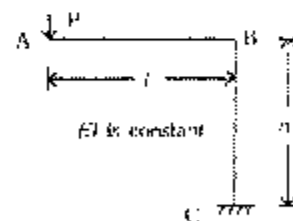
59.



A pin-jointed lower truss is loaded as shown in the above figure. The force induced in the member DF is

- 1.5 kN (tension)
- 4.5 kN (tension)
- 1.5 kN (compression)
- 4.5 kN (compression)

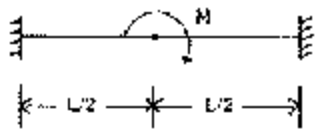
60.



An elementary structural frame ABC consists of a vertical member BC and a cantilever beam AB which carries a load P at the free end A, as shown in the above figure. The bending moment diagram consists of

- Triangle for both AB and BC
- Rectangle for both AB and BC
- Triangle for AB and rectangle for BC
- Rectangle for AB and triangle for BC

61.



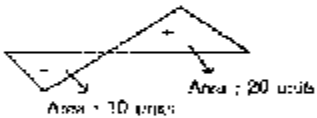
A fixed beam as shown in the above figure has a span L and uniform flexural rigidity EI . It is subjected to a concentrated clockwise moment M at the centre. The deflection at the center of the beam is

- a. $ML^2/8EI$ upwards
- b. $ML^2/8EI$ downwards
- c. Zero
- d. $ML^2/384EI$ downwards

62. A three-span continuous beam is fixed at its ends and supported by two rigid supports in between. The order of the reduced stiffness matrix for this beam is

- a. $[3 \times 3]$
- b. $[1 \times 1]$
- c. $[2 \times 2]$
- d. $[4 \times 4]$

63.



Influence line diagram for a truss member is shown in the above figure. Positive values indicate tension. Dead load on the truss is 20 kN/m and the live load is 10 kN/m . Live load is longer than the span. Maximum tensile force in the member is

- a. 600 kN
- b. 400 kN
- c. 300 kN
- d. 200 kN

64. Bentonite is a material obtained due to the weathering of

- a. Limestone
- b. Quartzite
- c. Volcanic ash
- d. Shales

65. Match List I with list ii and select the correct answer:

List I (Type of soil)

- A. Lacustrine
- B. Alluvial
- C. Aelian

D. Marine

List II (Feature)

- 1. Transported by wind
- 2. Transported by running water
- 3. Deposited at the bottom of lakes
- 4. Deposited in sea water

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

66. Given for a sample of a soil
 Void ratio at the densest state = 0.40
 Void ratio at the loosest state = 1.20
 Which one of the following correctly represents the relative density of a sample prepared with a void ratio of 1.0?

- a. 17.5%
- b. 25%
- c. 37.5%
- d. 47.5%

Match List I (Different types of soil) with list ii (Group symbols of LS classification) and select the correct answer

List I

- A. Well graded gravel sand mixture with little or no fines
- B. Poorly graded sands or gravel sands with little or no fines
- C. Inorganic silts and very fine sands or clayey silts with low plasticity
- D. Inorganic clays of high plasticity

List II

- 1. ML
- 2. CH
- 3. GW
- 4. SP

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

68. The term 'Loess' indicates those soils which are

- 1. Uniformly graded
- 2. Poorly graded
- 3. Made up of 50% or more and size particles

4. Made up of more than 50% of silt particles

Which of the above statements are correct?

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

69. The best indication of the behavior of a deposit of sand under load can be obtained from its

- a. Bulk density
- b. Dry density
- c. Relative density
- d. Grading

70. Match List I (Activity type) with List II (Representation by) and select the correct answer:

List I

- A. Artificially introduced
- B. Critical
- C. Non-critical type
- D. Dangler

List II

- 1. A single thick arrow
- 2. A single arrow
- 3. An arrow emerging from an event but not entering into any event
- 4. A dotted arrow

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

71. Consider the following statements

- 1. A dummy activity is artificially introduced in a network when necessary
- 2. A dummy activity consumes some time
- 3. A dummy activity is represented by a dotted arrow
- 4. A dummy activity must incessantly be introduced in every network

Which of the above statements are correct?

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

72. Overhead expenses on a project are included in

- a. Indirect cost
- b. Direct cost
- c. Variable cost
- d. Fixed cost

73. In the cost optimization procedure the cost slope for each activity can be estimated by the formula

- a. $\frac{\text{crash cost} - \text{normal cost}}{\text{crash time} - \text{normal time}}$
- b. $\frac{\text{crash time} - \text{normal time}}{\text{crash cost} - \text{normal cost}}$
- c. $\frac{\text{normal time} - \text{crash time}}{\text{crash cost} - \text{normal cost}}$
- d. $\frac{\text{crash cost} - \text{normal cost}}{\text{normal time} - \text{crash time}}$

74. Budgeting with Bar chart is a tool to find

- a. Total cost of project
- b. Total time along with cost of project
- c. Direct cost of project
- d. Direct cost of project

75. A machine costing Rs. 8,500 will have a scrap value of Rs. 300. Machines of this class have a working hour average life of 25,000 hours. What will be the depreciation charge at the end of the first year, if the machine is operated for a total of 1500 hours? (use straight line method of depreciation)

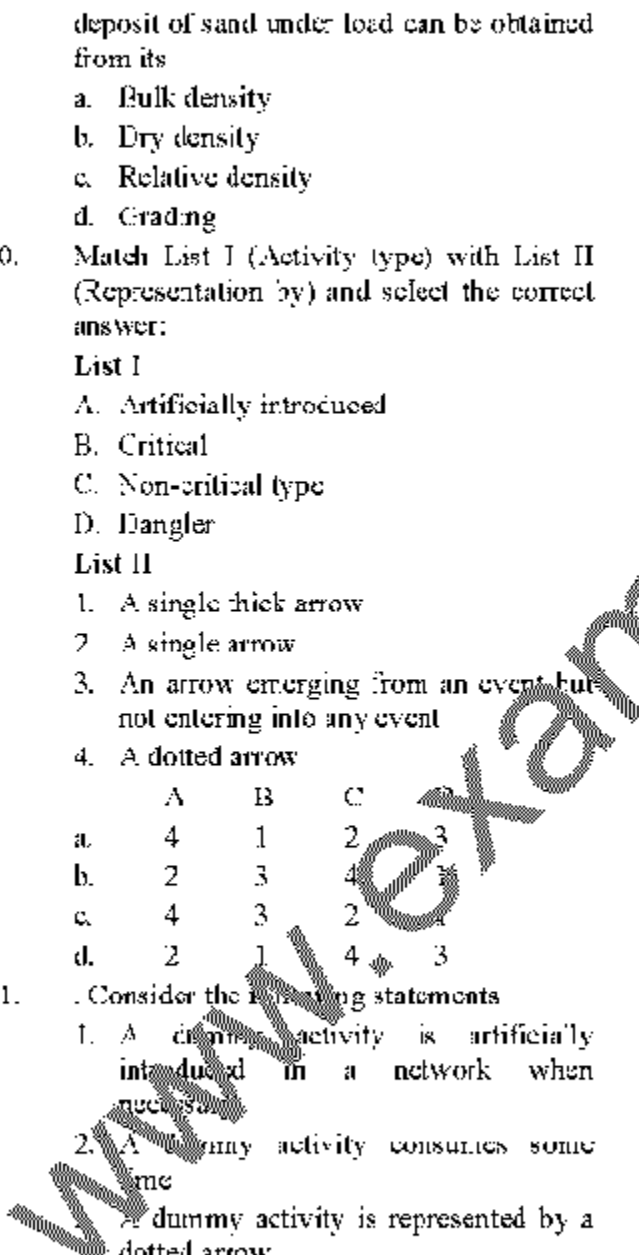
- a. Rs 492.00
- b. Rs 542.00
- c. Rs 548.50
- d. Rs 692.00

76. In discrete rate of return computations, the single payment compound amount factors for 7 % interest rate for 1, 2, 3, 4 and 5 years are respectively 1.0700, 1.1449, 1.2250, 1.3108, 1.4026. The uniform series compound amount factor for 7% discrete rate of return for 4 years will be nearly

- a. 5.25
- b. 5.10
- c. 4.68
- d. 4.44

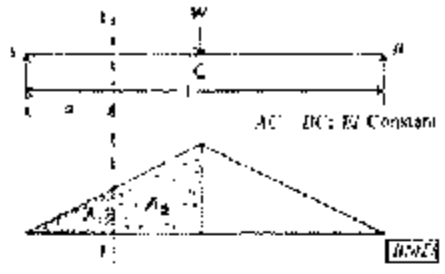
77. The most versatile method used in appraising project profitability is

- a. Pay back method
- b. Accounting rate of return



- c. Internal rate of return
- d. Net present value index method

78.



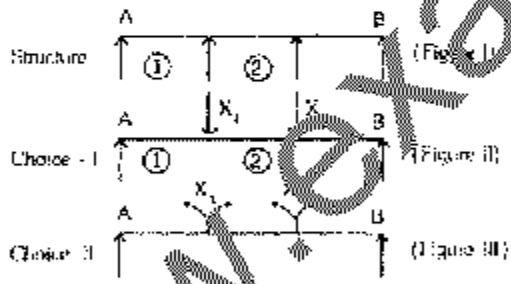
Assertion (A): For central load on a simple beam shown above, the deflection at section 1-1 any where in

$$\Delta C = \Delta_{1-1} = \frac{1}{EI} (\text{moment of } A_1 \text{ about } 1-1)$$

Reason (R): The deflection at the section 1-1 = mid span deflection = $\frac{1}{EI}$ (moment of A_2 about 1-1)

- 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.



For the continuous beam shown in the above figure I while applying force method, the choices of release are available as shown in figure II and III

Assertion (A): Choice I is preferable since it will result in conditioned matrix.

Reason (R): Well conditioned matrix has leading diagonal terms dominant, which results in accurate solution.

- 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 position of the directory of the path of a projectile depends upon the initial speed.

Reason (R): It also depends upon the angle of projection.

- 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):** Kani's method is better than the moment distribution method.

Reason (R): In the moment distribution method, the errors get stored but in the Kani's method the errors get eroded

- 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

Assertion (A): The critical shear stress causing failure of soil below foundation depends upon properties of soil as well as on normal stress on the failure plane

Reason (R): The ultimate strength of material is determined by the stresses in the potential failure plane (or plane of slip).

- 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):** A skillful highway designer builds in' speed control at critical locations on horizontal curves rather to increase the super elevation.

Reason (R): A driver slows down on horizontal curve due to feeling of discomfort because of increase in side friction with reduced super elevation.

- 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. **Assertion (A):** The coefficient of dynamic viscosity (μ) as its nomenclature indicates, is an absolute constant for a given fluid.
Reason (R): Newton's universally accepted definition for absolute viscosity shows that it is a coefficient in the form of a ratio between stress and rate of shear strain.
- Both A and R are true and R is the correct explanation of A
 - Both A and R are true but R is NOT the correct explanation of A
 - A is true but R is false
 - A is false but R is true
85. **Assertion (A):** A rectangular floating vessel which has been determined as stable in rolling is bound to be more stable in pitching.
Reason (R): Moment of inertia of vessels cross-sectional are at water surface level is more about transverse axis than about longitudinal axis.
- Both A and R are true and R is the correct explanation of A
 - Both A and R are true but R is NOT the correct explanation of A
 - A is true but R is false
 - A is false but R is true
86. **Assertion (A):** $\phi = y^4 - 6x^2y^2$ is not the valid velocity potential function of a 2-dimensional flow field.
Reason (R): The function does not satisfy equation of continuity and condition of irrotationality.
- Both A and R are true and R is the correct explanation of A
 - Both A and R are true but R is NOT the correct explanation of A
 - A is true but R is false
 - A is false but R is true
87. **Assertion (A):** For a given specific energy in a prismatic channel, the critical state of flow corresponds to maximum discharge.
Reason (R): Gradient of discharge w.r.t. depth dQ/dy is maximum when depth is equal to critical depth which comprises critical state of flow.
- Both A and R are true and R is the correct explanation of A
 - Both A and R are true but R is NOT the correct explanation of A
 - A is true but R is false
88. **Assertion (A):** Chlorine, when added to water for disinfection purposes, will be present in HOCl form which further disassociates to produce OCl⁻ ions
Reason (R): The chlorine molecule will split into Cl[•] which will take part in the disinfecting action.
- Both A and R are true and R is the correct explanation of A
 - Both A and R are true but R is NOT the correct explanation of A
 - A is true but R is false
 - A is false but R is true
89. **Assertion (A):** The air flow process involved in the sequential batch reactor and conventional activated sludge process is identical.
Reason (R): Aeration and sedimentation/clarification are carried out in both systems.
- Both A and R are true and R is the correct explanation of A
 - Both A and R are true but R is NOT the correct explanation of A
 - A is true but R is false
 - A is false but R is true
90. **Assertion (A):** PERT is used in such situations where durations of activities are known with certainty.
Reason (R): In PERT three different activity times are used to estimate the expected time.
- Both A and R are true and R is the correct explanation of A
 - Both A and R are true but R is NOT the correct explanation of A
 - A is true but R is false
 - A is false but R is true
91. **Assertion (A):** The delay in the performance of a critical activity will delay the completion of the project.
Reason (R): The float of critical activity is negative.
- Both A and R are true and R is the correct explanation of A
 - Both A and R are true but R is NOT the correct explanation of A
 - A is true but R is false
 - A is false but R is true
92. For distinguishing clays from silts in the field, a moist soil is rolled into a thread of 3 mm diameter. www.examtips.com

- a. Dilatancy
 - b. Dry strength
 - c. Wet and manipulate strength
 - d. Toughness
93. By placing a soil sample at 105°C for 24 hours in an oven

- 1. Hygroscopic moisture is lost
- 2. Capillary water is lost
- 3. Free water is lost
- 4. Structural water is lost

Which of the above statements are correct?

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

94. Soil sample A and B have void ratios of 0.5 and 0.7 respectively. If 1.5 m³ of soil sample A and 1.7 m³ of soil sample B are mixed to form sample C having a volume of 3.2 m³, which one of the following correctly represents the porosity of sample C?

- a. 0.375
- b. 0.60
- c. 1.66
- d. 2.66

95. A retaining wall 8m high with a smooth vertical back retains a clay backfill with 15kN/m², φ = 15° and γ = 18kN/m³.

(Given sin 15° = 0.25), the pressure at the top will nearly be equal to

- a. 35.2 kN/m²
- b. 23.0 kN/m²
- c. 27.6 kN/m²
- d. 11.5 kN/m²

96. The results of consolidation test on a sample of clay, having a thickness of 19 mm indicate that half the ultimate compression occurs in the first 5 minutes. Under similar drainage conditions, the time required for a building on a 3.65 m layer of the same clay to experience half of its final settlement will be

- a. 16 days
- b. 32 days
- c. 64 days
- d. 128 days

97. In Terzaghi's bearing capacity analysis, the soil wedge immediately below the footing remains in a state of

- a. Plastic equilibrium
- b. Radial shear
- c. Elastic equilibrium

- d. Linear shear
98. Consider the following factors
- 1. Geometrics of the footing
 - 2. Settlement and its rate for foundation soil
 - 3. Permeability of the soil
 - 4. Shear parameters of the soil
 - 5. Taylor's stability number

Which of these factors are to be taken into reckoning for assessing the allowable bearing capacity of a foundation soil?

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

99. If D₁ = inside diameter of cutting edge of drive shoe, D₂ = the maximum outside diameter of the cutting edge, D₃ = the inside diameter of soil sampler tube, D₄ = the outside diameter of soil sampler tube; the area ratio of sampler will be

- a. $\frac{D_2^2 - D_1^2}{D_3^2}$
- b. $\frac{D_2 - D_1}{D_3}$
- c. $\frac{D_2 - D_1}{D_4}$
- d. $\frac{D_2^2 - D_3^2}{D_4^2}$

100. Match List I (Type of curve) with List II (Design factor) and select the correct answer:

List I

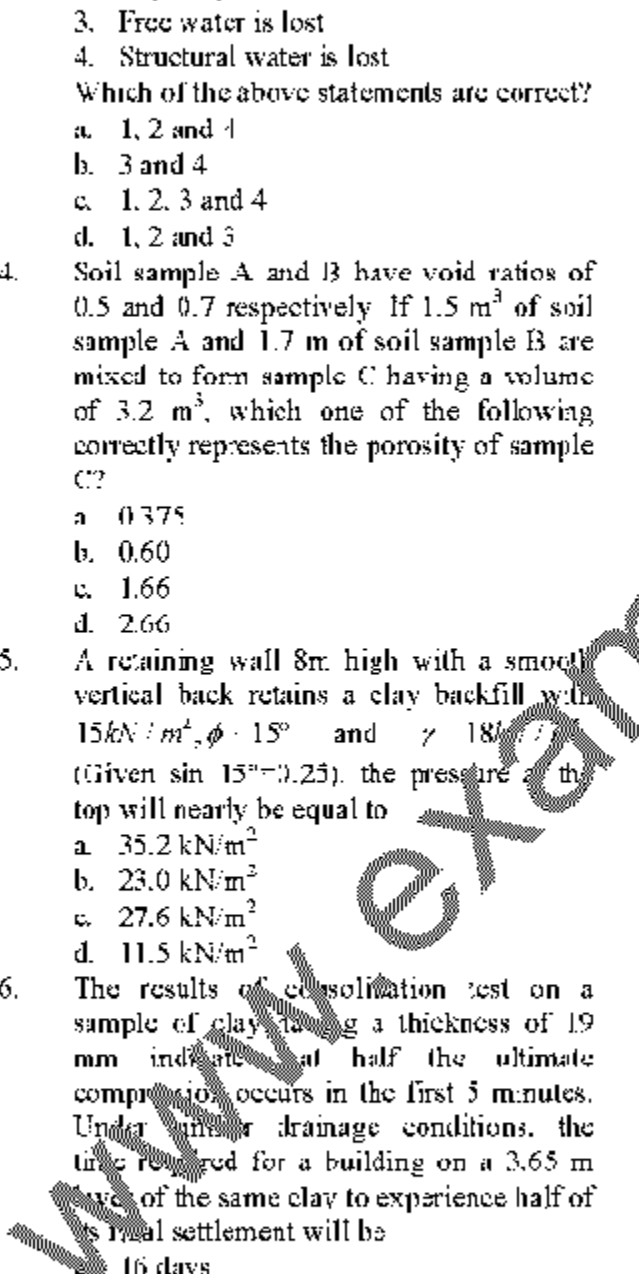
- A. Summit curve
- B. Sag curve
- C. Horizontal curve
- D. Transition curve

List II

- 1. Super elevation runoff
- 2. S setback distance
- 3. Headlight sight distance
- 4. Right of way
- 5. Passing sight distance

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

101. Bituminous materials are used in highway construction primarily



- Cementing and water-proofing properties
- Load bearing capacity
- High specific gravity
- Black colour which facilitates road marking

102. Consider the following factors

- Magnitude of load
- Thickness of cement concrete slab
- Temperature distribution in the slab
- Modulus of sub grade reaction

Which of these should be taken into reckoning to determine the wheel load stress at critical location in a cement concrete pavement?

- 1, 2 and 3
- 1 and 3
- 3 and 4
- 1, 2 and 4

103. If the pressure carried by a CBR specimen at 2.5 mm penetration is 3.5 N/mm^2 , the CBR of the soil is

- 10%
- 35%
- 50%
- 70%

104. What shall be the density in kg/m^3 of bituminous concrete with 6% bitumen and 3% air voids? (Specific gravity of aggregates and bitumen are 2.65 and 1.0 respectively)

- 2603
- 2415
- 2342
- 2303

105. Which one of the following methods of O-D traffic survey is conducted for comprehensive analysis of traffic and transportation data?

- Home interview
- Keypoint interview
- Registration number method
- Postcard number

106. The lost time due to starting delay on a traffic signal is noted to be 3s, the actual green time is 25s and yellow time is 3s. How much is the effective green time?

- 31s
- 28s
- 25s
- 22s

107. A locomotive has four pairs of driving wheels carrying an axle load of 24×10^4

N. The maximum load that can be pulled if the coefficient of friction is $1/6$, is

- $32 \times 10^4 \text{ N}$
- $16 \times 10^4 \text{ N}$
- $8 \times 10^4 \text{ N}$
- $4 \times 10^4 \text{ N}$

108. Consider the following statements associated with prestressed concrete sleepers:

- Concrete used is M25
 - These are heavily damaged in case of derailment
 - These are suitable for track circuiting
- Which of these statements is/are correct?

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

109. Permissible limit of cant deficiency for broad Gauge (B.G.) is

- 50 mm
- 60 mm
- 75 mm
- 88 mm

110. If the flange angle is β , coefficient of friction between flange and rail is μ , the derailment coefficient according to Nadal's formula should not exceed

- $\frac{\tan \beta \cdot \mu}{1 - \mu \sqrt{\cot \beta}}$
- $\frac{\sqrt{\tan \beta \cdot \mu}}{1 - \mu \sqrt{\cot \beta}}$
- $\frac{\tan^2 \beta - \mu}{1 - \mu \cot \beta}$
- $\frac{\tan \beta \cdot \mu}{1 - \mu \tan \beta}$

111. In signals system design of Railways the distance at which the outer signal is to be placed is decided on basis of the

- Allowable speed
- Running speed
- Minimum speed
- Journey speed

112. Consider the following factors

- Elevation
- Temperature
- Gradient
- Trip length

For finding the runway length, which of these are taken into reckoning?

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

113. A surface longitudinally centered on the extended runway centre line and extending outward and upward from each end of the primary surface is known as

- a. Conical surface
 b. Transition surface
 c. Approach surface
 d. Horizontal surface

114. A cylindrical vessel open at the top is filled with water and rotated at a constant angular velocity about its vertical axis such that the bottom of the vessel is just exposed at the axis. The volume of water spilled as a fraction of the volume of the cylinder is

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

115. A uniform horizontal pipe of length 120 cm leads from a reservoir holding water to a depth of 90 cm above the open end of the pipe. What minimum length of piezometer is required to measure pressure at a point 40 cm from the open end?

- a. 90 cm
 b. 60 cm
 c. 30 cm
 d. 10 cm

116. Choose the correct statement about horizontal component of resultant hydrostatic pressure on a curved submerged surface

- a. It is equal to the product of pressure at the centre and the curved area
 b. It is equal to the weight of the liquid above the curved surface acting at 0.5 depth of the surface
 c. It is equal to the projected area of the surface on a vertical plane multiplied by the pressure at the centre of gravity of area
 d. It is equal to the weight of the liquid above the curved surface multiplied by the projected area on a vertical plane

117. The velocity distribution for the flow between two parallel plates 0.3 m apart is parabolic and the maximum velocity at the

centre is 0.5 m/s. The rate of flow per unit length is

- a. $1 \text{ m}^3/\text{s}$
 b. $0.01 \text{ m}^3/\text{s}$
 c. $10 \text{ m}^3/\text{s}$
 d. $0.1 \text{ m}^3/\text{s}$

118. The viscosity of water as compared to that of air is about

- a. 50 times
 b. 55 times
 c. 60 times
 d. 65 times

119. A pipeline of diameter 10 cm carries a discharge at a velocity of 1 m/s. It branches into pipes each of diameter 5 cm. Consider the following statements

- The velocity in each branch is 2 m/s
- The discharges in the two branched pipes are equal
- The rate of flow before and after branching is the same
- The velocity in 5 cm pipe is half of that in 10 cm pipe

Select the correct answers using the codes given below:

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

120. Match List I (Descriptive aspects of notches) with List II (Names of notches/weirs) and select the correct answer.

List I

- A. Notch in which end contractions do not figure in the equation
 B. Notch in which the exponent n in $Q = KH^n$ is 5/2
 C. Notch which is not ventilated
 D. Notch in which discharge varies directly as the head

List II

- Depressed notch
- Proportional weir
- Vee notch
- Cippolletti weir

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