

*Civil Engineering*

*17.03.2019 FN 9.30-11.30 AM*

1. In '*Float Glass*' manufacturing, the molten glass coming out of the furnace is allowed to float on:
  - (a) Molten Lead
  - (b) Steel Plate
  - (c) Molten Zinc
  - (d) Molten Tin
  
2. When rain water falls on hot bricks, the deformed shape is called:
  - (a) Checks
  - (b) Chuffs
  - (c) Spots
  - (d) Blisters
  
3. The Cement Clinker formed consequent to burning contains the Bogue compound called 'Belite' which has the chemical formula:
  - (a)  $3CaO.SiO_2$
  - (b)  $3CaO.Al_2O_3$
  - (c)  $2CaO.SiO_2$
  - (d)  $4CaO.Al_2O_3.Fe_2O_3$

4. Which one of the following components in cement has to be minimized to qualify as Low Heat Cement(LHC)?
- (a) Tricalcium Silicate
  - (b) Dicalcium Silicate
  - (c) Tricalcium Aluminate
  - (d) Tetra Calcium Alumina Ferrite
5. The rate of creep decreases with time; creep strains after what duration are taken as terminal values?
- (a) 5 yrs
  - (b) 6 yrs
  - (c) 7 yrs
  - (d) 8 yrs
6. As per IS: 383 – 1970, percentage passing of sand from 600 *micron* sieve by weight for Zone-I and Zone-II sands are, respectively:
- (a) 30 – 70 and 55 – 90
  - (b) 15 – 34 and 35 – 59
  - (c) 60 – 95 and 75 – 100
  - (d) 05 – 20 and 08 – 30

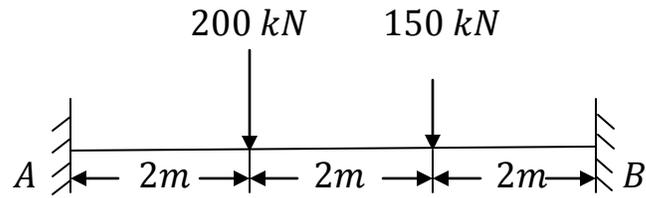
7. The most suitable aggregate for high strength concrete and for pavements is:
- (a) Rounded aggregates
  - (b) Irregular aggregates
  - (c) Angular aggregates
  - (d) Flaky aggregates
8. The best method of placing concrete underwater is by:
- (a) Pipes and pumps
  - (b) Bottom Dump Buckets
  - (c) Termie Pipe
  - (d) Filling cement bags with dry and semi-dry mix of cement and aggregates
9. A steel cube of  $200\text{ mm}$  is placed at a depth of  $4\text{ km}$  in sea. For steel  $E = 208\text{ GPa}$ ,  $\nu = 0.29$  and the density of sea water is  $0.01\text{ N/cm}^3$ . The change in volume of the cube will be nearly:
- (a)  $1710\text{ mm}^3$
  - (b)  $1820\text{ mm}^3$
  - (c)  $1940\text{ mm}^3$
  - (d)  $2020\text{ mm}^3$

10. A block of material is subjected to a tensile strain of  $12 \times 10^{-6}$  and a compressive strain of  $15 \times 10^{-6}$  on planes at right angles to each other. There is also a shear strain of  $12 \times 10^{-6}$  and there is no strain on planes at right angles to the above planes. The direction of principal strains will be nearly:
- (a)  $24^\circ$  and  $114^\circ$
  - (b)  $10^\circ$  and  $100^\circ$
  - (c)  $12^\circ$  and  $102^\circ$
  - (d)  $100^\circ$  and  $190^\circ$
11. A steel wire 5 mm in diameter is used for hoisting purposes during construction of a building. 100 m length of the wire is hanging vertically and a load of 0.6 kN is being lifted held at its lower end (specific weight of steel is  $0.008 \text{ kg/cm}^3$ ). The elongation of the wire will be nearly: (Given  $E = 210 \text{ GPa}$ )
- (a) 12 – 13 mm
  - (b) 14 – 15 mm
  - (c) 16 – 17 mm
  - (d) 18 – 19 mm
12. Two mutually perpendicular planes of an element of material are subjected to direct stresses of  $10.5 \text{ MN/m}^2$  (Tensile) and  $3.5 \text{ MN/m}^2$  (Compressive) along with a shear stress of  $7 \text{ MN/m}^2$ . The magnitude of the major principal stress will be:
- (a)  $3.4 \text{ MN/m}^2$  (Compression)
  - (b)  $6.4 \text{ MN/m}^2$  (Tensile)
  - (c)  $7.0 \text{ MN/m}^2$  (Compression)
  - (d)  $13.4 \text{ MN/m}^2$  (Tensile)

13. A certain type of steel has yield strength of  $270 \text{ N/mm}^2$ . At a point in the strained region, the principal stresses are  $+120 \text{ N/mm}^2$ ,  $+80 \text{ N/mm}^2$  and  $-30 \text{ N/mm}^2$ . If  $\nu = 0.285$ , the factor of safety according to maximum principal strain theory will be:
- (a) 1.30
  - (b) 2.55
  - (c) 3.25
  - (d) 3.60
14. The internal pressure in a steel drum is  $10 \text{ N/mm}^2$ . The maximum circumferential stress is  $85 \text{ N/mm}^2$  and longitudinal stress is  $22 \text{ N/mm}^2$ . For Poisson's ratio = 0.3, the equivalent tensile stress in a simple tensile test by Distortion energy theory will be nearly:
- (a)  $96 \text{ N/mm}^2$
  - (b)  $91 \text{ N/mm}^2$
  - (c)  $87 \text{ N/mm}^2$
  - (d)  $84 \text{ N/mm}^2$
15. On the perpendicular planes of a body, direct stresses are  $+150 \text{ N/mm}^2$  and  $-90 \text{ N/mm}^2$ . The major principal stress at a point is  $200 \text{ N/mm}^2$ . The relevant shearing stress applied to the given planes will be:
- (a)  $240.8 \text{ N/mm}^2$
  - (b)  $120.4 \text{ N/mm}^2$
  - (c)  $60.2 \text{ N/mm}^2$
  - (d)  $30.1 \text{ N/mm}^2$

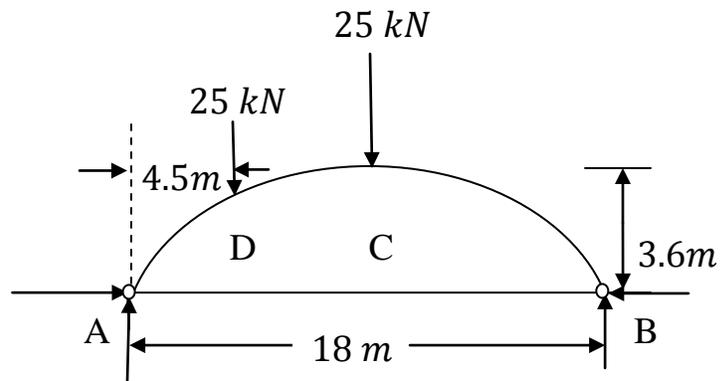
16. A close-coiled helical spring has a stiffness of  $10 \text{ N/mm}$ . The length of the spring when fully compressed with adjacent coils in contact is  $400 \text{ mm}$ . The ratio of spring wire and coil diameter is  $\frac{1}{10}$  and the modulus of rigidity of the material of the spring is  $80 \text{ GPa}$ . The diameter of the spring wire and the mean diameter of the coils will respectively, be:
- (a)  $10 \text{ mm}$  and  $100 \text{ mm}$
  - (b)  $15 \text{ mm}$  and  $150 \text{ mm}$
  - (c)  $20 \text{ mm}$  and  $200 \text{ mm}$
  - (d)  $25 \text{ mm}$  and  $250 \text{ mm}$
17. If a beam of solid circular section is subjected to a transverse shear force  $S$ , then the maximum shear stress  $\tau_{max}$  is equal to:
- (a)  $\frac{3}{2}\tau_{mean}$
  - (b)  $\frac{4}{3}\tau_{mean}$
  - (c)  $\frac{5}{3}\tau_{mean}$
  - (d)  $\frac{3}{4}\tau_{mean}$
18. An aluminium wire of  $5 \text{ mm}$  diameter twisted for one complete revolution without exceeding a shear stress of  $42 \text{ MN/m}^2$  and  $C = 27 \text{ GN/m}^2$ . The length of the wire will be nearly:
- (a)  $10.1 \text{ m}$
  - (b)  $7.6 \text{ m}$
  - (c)  $5.1 \text{ m}$
  - (d)  $1.6 \text{ m}$

19. A fixed beam is loaded as shown in figure.



The fixed end moments at supports A and B are respectively:

- (a) 244.44  $kNm$  and 202.12  $kNm$   
 (b) 234.42  $kNm$  and 202.12  $kNm$   
 (c) 244.44  $kNm$  and 222.22  $kNm$   
 (d) 234.42  $kNm$  and 222.22  $kNm$
20. The horizontal thrust of the two-hinged arch loaded as shown in figure is:



- (a) 47.81  $kN$   
 (b) 44.42  $kN$   
 (c) 41.81  $kN$   
 (d) 38.42  $kN$

21. The deflection at the free end of a cantilever beam subjected to uniformly distributed load of intensity  $w$  / *unit* length is:
- (a)  $\frac{wl^4}{24 EI}$
  - (b)  $\frac{wl^4}{30 EI}$
  - (c)  $\frac{wl^4}{84 EI}$
  - (d)  $\frac{wl^4}{8 EI}$
22. Two point loads of 40 *kN* and 60 *kN* and spaced 5 *m* apart cross a girder of 16 *m* span with 40 *kN* load leading. The magnitude of maximum bending moment under 60 *kN* load will be:
- (a) 234.30 *kNm*
  - (b) 306.25 *kNm*
  - (c) 402.25 *kNm*
  - (d) 326.20 *kNm*
23. In a vibrating system the undamped and damped resonant frequencies are 10 and 9 *cycles /sec* respectively. The damping ratio will be nearly:
- (a) 0.35
  - (b) 0.38
  - (c) 0.48
  - (d) 0.44

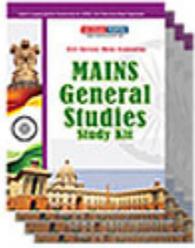
24. A cable of span  $120\text{ m}$  and central dip of  $12\text{ m}$  is carrying a load of  $20\text{ kN/m}$  of horizontal length. The temperature of the cable rises through  $20^\circ\text{ F}$ . If  $\alpha = 6 \times 10^{-6}$  per  $^\circ\text{F}$ , the change in horizontal tension will be:
- (a)  $6.75\text{ kN}$  (increase)
  - (b)  $3.375\text{ kN}$  (increase)
  - (c)  $3.375\text{ kN}$  (decrease)
  - (d)  $6.75\text{ kN}$  (decrease)
25. A suspension cable of  $60\text{ m}$  span and of central dip of  $6\text{ m}$  is strengthened by two-hinged stiffening girders. The dead load of stiffening girder is  $20\text{ kN/m}$ . The girder also carries a live load of  $30\text{ kN/m}$  over the left half of the span. The maximum tension in the cable will be nearly:
- (a)  $2581\text{ kN}$
  - (b)  $2663\text{ kN}$
  - (c)  $2745\text{ kN}$
  - (d)  $2827\text{ kN}$

26. Consider the following statements with reference to working stress method of design:
1. The members in compression are subjected to forces applied at appropriate eccentricities.
  2. The members in tension are subjected to longitudinal forces applied over the net area of the section
  3. All connections are virtually flexible

Which of the above statements are correct?

- (a) 1 and 2 only
  - (b) 1 and 3 only
  - (c) 2 and 3 only
  - (d) 1, 2 and 3
27. An *ISA 60 mm × 60 mm × 8 mm* is used as a tension member and is connected to a gusset plate by one leg using 18 mm diameter rivets in one chain line. With taking a yield stress in the case as  $260 \text{ N/mm}^2$ , the tensile strength of the member will be nearly:
- (a) 81 kN
  - (b) 85 kN
  - (c) 92 kN
  - (d) 98 kN

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28. Consider the following statements in respect of residual stresses:

1. Compressive stress across the cross-section becomes non-uniform due to the presence of residual stresses
2. The nonlinear portion of the average stress-strain curve for an axially loaded compression member is due to residual stresses
3. Residual stresses are dependent on yield stress

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
29. A simply supported beam carries an uniformly distributed load of  $45 \text{ kN/m}$  including self weight over a span of  $8 \text{ m}$ . The effective length of compression flange of the beam is also  $8 \text{ m}$ . The section modulus required will be nearly:
- (a)  $2320 \times 10^3 \text{ mm}^3$
  - (b)  $2180 \times 10^3 \text{ mm}^3$
  - (c)  $1820 \times 10^3 \text{ mm}^3$
  - (d)  $1410 \times 10^3 \text{ mm}^3$

30. Consider the following statements in respect of design of riveted connections:

1. The load taken by the rivets along the axis is more than the edges
2. The bearing stress is assumed to be uniform between the contact surfaces of plate and rivet
3. The bending stress in plate is neglected
4. The friction between plates is neglected

Which of the above statements are correct?

- (a) 1, 2 and 3 only
  - (b) 1, 2 and 4 only
  - (c) 2, 3 and 4 only
  - (d) 1, 3 and 4 only
31. Two plates of sizes  $150\text{ mm} \times 10\text{ mm}$  and  $200\text{ mm} \times 10\text{ mm}$  are connected by a lap joint allowing a safe shear stress of  $110\text{ N/mm}^2$  in the weld. The permissible tensile stress is  $150\text{ N/mm}^2$  for a  $8\text{ mm}$  weld. The length of the weld at each side will be nearly:
- (a)  $100\text{ mm}$
  - (b)  $110\text{ mm}$
  - (c)  $120\text{ mm}$
  - (d)  $130\text{ mm}$

32. Consider the following statements in respect of stiffeners in plate girders:
1. The intermediate stiffeners prevent the web plate from buckling under inclined compressive stress.
  2. The vertical stiffeners are provided when the thickness of web is less than the limits specified for minimum thickness of the web plate

Which of the above statements is/ are correct?

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

33. Consider the following statements in respect of Gantry Girder:

1. The horizontal forces transverse to rails or along the rails do not act at the same time as vertical loads
2. The girder is subjected to bending in vertical and horizontal plane without twisting
3. Compression flange is subjected to horizontal and vertical loads

Which of the above statements is/are correct?

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

34. Consider the following statements with reference to ultimate load design for the frame:
1. The load carrying capacity of a plane frame is due mainly to the ability of the joints to transmit bending moments and not due to the resistance to bending of the members
  2. Ultimate load design is based on the relationship between bending moment and curvature for the frame

Which of the above statements is/are correct?

- (a) 1 only
  - (b) 2 only
  - (c) Both 1 and 2
  - (d) Neither 1 nor 2
35. Cornice in building masonry work is:
- (a) A building corner, constructed with the bricks or rocks
  - (b) A projecting ornamental course near the top of a building or at the junction of a wall and ceiling
  - (c) A slopping or stepped masonry projection from a tall wall intended to strengthen the wall against the thrust of a roof
  - (d) An extension of one or more course of stone or brick from the face of a wall to serve as a support for wall plates

36. In the design of shear reinforcement, the spacing of inclined stirrups is calculated by using the relation (using standard notations):

$$(a) \quad S_v = \frac{0.87 f_y \cdot A_{sv} d}{V_{us}}$$

$$(b) \quad S_v = \frac{0.87 f_y \cdot A_{sv} d}{V_{us}} (\sin \alpha + \cos \alpha)$$

$$(c) \quad S_v \leq \frac{A_{sv} \cdot f_y}{0.4 b}$$

$$(d) \quad S_v = \frac{0.87 f_y \cdot A_{sv} d}{(\tau_v - \tau_c) b}$$

37. The minimum area of reinforcement of any type or grade within a pile should be:

(a) 0.2 % of the cross-sectional area of the pile shaft

(b) 0.4 % of the cross-sectional area of the pile shaft

(c) 0.6 % of the cross-sectional area of the pile shaft

(d) 0.8 % of the cross-sectional area of the pile shaft

38. In the design of counterfort retaining wall, the depth of foundation below ground level shall be:

(a) *S.B.C. of soil*  $\times$  *active earth pressure*

$$(b) \quad \frac{P_0}{w} \left( \frac{1 - \sin \phi}{1 + \sin \phi} \right)^2$$

$$(c) \quad H \sqrt{\frac{\left( \frac{1 - \sin \phi}{1 + \sin \phi} \right)}{(1 - K)(3K - 1)}}$$

(d)  $\frac{wh^2}{2} \left( \frac{1 - \sin \phi}{1 + \sin \phi} \right) \times$  *spacing of counterforts*

39. Consider the following statements with reference to resistance to earthquakes:

1. Moment resisting space frames resist lateral forces
2. Shear wall systems resist lateral forces
3. Soft storey in multistoried buildings resists lateral forces

Which of the above systems are implemented to resist lateral forces in structures?

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

40. Curvature ductility in a structure can be increased by:

1. Decreasing the percentage tensile steel
2. Increasing the percentage compressive steel
3. Increasing the transverse reinforcement

Which of the above statements are correct?

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

41. For a stone masonry arch bridge, the thickness  $t$  of the arch ring by Trautwyne's equation is:

(a)  $\left[ \frac{(\sqrt{R+0.5L})}{7} + 0.06 \right]$

(b)  $\left[ \frac{(R+0.5L)^2}{2} + 0.6 \right]$

(c)  $\left[ \frac{(L^2+4r^2)}{8r} \right]$

(d)  $\left[ \frac{Span}{350} + 0.64 \right]$

42. Cycle time of a scrapper is 6 *minutes*; and that of a pusher to fill one scrapper is 1.5 *minutes*. The number of pushers to serve 10 scrappers will be:

(a) 6

(b) 5

(c) 3

(d) 2

43. A method by which two or more parties agree to refer a dispute arising between them to a third 'person' of their choice for a binding decision is called:

(a) Frustration of contract

(b) Cartel

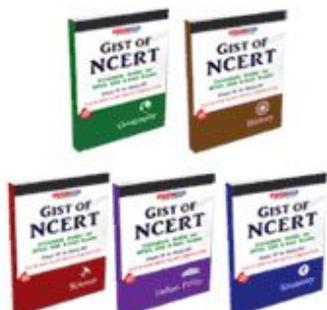
(c) Arbitration

(d) Compensation events

44.  $\frac{BCWP}{BCWS}$  indicate
- (a) Cost Variance
  - (b) Scheduled Variance
  - (c) Cost Performance Index
  - (d) Schedule Performance Index
45. The technique which:
1. Identifies the function of a product or service,
  2. Establishes a value for that function and achieving that function at the lowest total cost without degradation,
- is referred as:
- (a) Quality Control
  - (b) Inventory Identification
  - (c) Variety Reduction
  - (d) Value Engineering
46. A temporary endeavour to create a unique product or service can be called:
- (a) Project Control
  - (b) Project Management
  - (c) Project Review
  - (d) Project Coordination

47. Labour welfare measures are generally categorized as:
1. Economic Welfare Measures
  2. Recreational Welfare Measures
  3. Facilitative Welfare Measures
- (a) 1 and 2 only  
(b) 1 and 3 only  
(c) 2 and 3 only  
(d) 1, 2 and 3
48. Which of the following are the unsafe workplace behaviors that can lead to accidents?
1. Taking shortcuts
  2. Being over confident
  3. Beginning a task with complete instructions
  4. Poor Housekeeping
- (a) 1, 2 and 3 only  
(b) 1, 3 and 4 only  
(c) 1, 2 and 4 only  
(d) 2, 3 and 4 only
49. Which one of the following is *not* the cause of accidents?
- (a) Unsafe act by victim  
(b) Unsafe condition  
(c) Uninsured employee  
(d) Unsafe act by co-worker

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50. Which one of the following statements indicates unstable equilibrium of fully submerged bodies?
- (a) Centre of buoyancy should be below centre of gravity
  - (b) Centre of gravity should be below metacentre
  - (c) Centre of gravity should be above metacentre
  - (d) Centre of buoyancy should be above centre of gravity
51. For water hammer problems, the non-dimensional number which remains same for the model and prototype in the hydraulic modelling is:
- (a) Mach Number
  - (b) Euler Number
  - (c) Froude Number
  - (d) All of these
52. A pipe of diameter  $1.5\text{ m}$  is required to transport an oil of specific gravity  $0.9$  and viscosity  $0.003\text{ poise}$  at the rate of  $3\text{ cumecs}$ . Tests were conducted on a  $0.15\text{ m}$  diameter pipe for a viscosity of water is  $0.01\text{ poise}$ . The rate of flow in the model will be nearly:
- (a)  $90\text{ l/s}$
  - (b)  $80\text{ l/s}$
  - (c)  $70\text{ l/s}$
  - (d)  $60\text{ l/s}$

53. An open vertical rectangular tank is provided with a circular hole of 3 m diameter on one of its vertical sides. This hole is closed by a disk of 3 m diameter that can rotate about the horizontal diameter. When the water level in the tank is 4 m above the centre of the disk, the torque required to maintain the disk in equilibrium will be nearly:
- (a) 39 kNm
  - (b) 33 kNm
  - (c) 28 kNm
  - (d) 23 kNm
54. When an impeller is rotating, the water in contact with the impeller is also rotating. This is the case of:
- (a) Free vortex
  - (b) Forced vortex
  - (c) Magnus effect
  - (d) Potential effect
55. Which of the following relations are correct?
1. Absolute pressure = Atmospheric pressure + Gauge pressure
  2. Absolute pressure = Atmospheric pressure – Vacuum pressure
  3. Absolute pressure = Atmospheric pressure + Vacuum pressure
  4. Absolute pressure = Atmospheric pressure - Gauge pressure
- (a) 1 and 4 only
  - (b) 1 and 2 only
  - (c) 2 and 3 only
  - (d) 3 and 4 only

56. At what pressure the Cavitation is expected at the inlet of pump that is handling water at  $20^{\circ}C$ ?
- (a)  $2.34 \text{ kN/m}^2$
  - (b)  $4.64 \text{ kN/m}^2$
  - (c)  $7.38 \text{ kN/m}^2$
  - (d)  $10.64 \text{ kN/m}^2$
57. Which of the following Hydrological data are required for irrigation and water power engineering?
- 1. Precipitation data
  - 2. Evaporation and transpiration data
  - 3. Stream flow data
  - 4. Infiltration characteristics of the area
- (a) 1, 2 and 3 only
  - (b) 1, 2 and 4 only
  - (c) 1, 3 and 4 only
  - (d) 1, 2, 3 and 4
58. Shrouding is provided in:
- (a) Slotted type tube wells
  - (b) Cavity type tube wells
  - (c) Strainer type tube wells
  - (d) Perforated type tube wells

59. What are the assumptions and limitations of Dupuit's theory?

1. The velocity of the flow is proportional to the tangent of the hydraulic gradient instead of sine
2. The flow is horizontal and uniform everywhere in the vertical section
3. Aquifer is homogeneous, isotropic and of infinite aerial extent

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

60. Consider the following data regarding healthy growth of a crop:

Field Capacity	= 29%
Permanent Wilting point	= 11%
Specific gravity of soil	= 1.3
Effective depth of root zone	= 700 mm
Daily Consumptive use	= 12 mm
Coefficient applicable porosity	= 0.75

Watering interval will be nearly:

- (a) 10 days  
(b) 12 days  
(c) 20 days  
(d) 24 days

61. A sprinkler system is to be provided to apply water at the rate of  $1.25 \text{ cm/hr}$ . Two  $186 \text{ meters}$  long sprinkler lines are required. 16 sprinklers are spaced at  $12 \text{ meters}$  intervals on each line. The spacing between lines is  $18 \text{ meters}$ . The required capacity of a sprinkler system will be:
- (a)  $30 \text{ litres/sec}$
  - (b)  $24 \text{ litres/sec}$
  - (c)  $18 \text{ litres/sec}$
  - (d)  $12 \text{ litres/sec}$
62. Using Francis' formula, the discharge of a rectangular weir  $45 \text{ cm}$  long with a head of  $12 \text{ cm}$  with no end contraction will be:
- (a)  $34.4 \text{ litres/sec}$
  - (b)  $31.6 \text{ litres/sec}$
  - (c)  $29.4 \text{ litres/sec}$
  - (d)  $24.6 \text{ litres/sec}$
63. Canal serving to divert excess flood water is called:
- (a) Inundation canal
  - (b) Ridge canal
  - (c) Perennial canal
  - (d) Branch canal

64. The ratio of the rate of change of discharge of an outlet to the rate of change of discharge of the distributing channel, is known as:
- (a) Efficiency
  - (b) Flexibility
  - (c) Sensitivity
  - (d) Modular limit
65. Which one of the following is a structure together with hydro-mechanical devices that controls and regulates the water from the reservoir to a canal in predetermined quantities?
- (a) Sluice off-take regulator
  - (b) Head regulator
  - (c) Cross regulator
  - (d) Sluicing outlet
66. A velocity field given by  $u = 3y^2$ ,  $v = 2x$  and  $w = 0$ , in an arbitrary units is associated with temperature field  $T = 4xy^2$ , in arbitrary units. The rate of change  $\frac{DT}{Dt}$  at a point  $(x, y) = (2, 1)$  will be:
- (a) 82 units
  - (b) 76 units
  - (c) 72 units
  - (d) 66 units

67. Consider the following standards of water quality:

1. Fe-0.25, TDS - 50, Suspended Solids -500, Hardness -100, pH 6-8
2. Fe-0.25, TDS - 500, Chloride -200, Hardness -200
3. Fe-1.0, TDS - 200, Suspended Solids -1000, pH -9

Which of the above standards suit the textile industry?

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

68. Analysis of a water sample shows the presence of free  $CO_2$  in water at 3 p.m. The amount of lime,  $CaO$  as required to remove this free  $CO_2$  will be nearly:

- (a) 3.8 mg/l
- (b) 4.6 mg/l
- (c) 5.8 mg/l
- (d) 6.6 mg/l

69. Which one of the following sewer appurtenances is associated with 'Siphonic' action?

- (a) Inverted Siphon
- (b) Catch Basin
- (c) Automatic Flushing Tank
- (d) Drop Man hole

70. Which one of the following form of Nitrogen present in waste water and sewage indicates well oxidized and treated waste water?
- Nitrite Nitrogen
  - Ammonia Nitrogen
  - Albuminoid Nitrogen
  - Nitrate Nitrogen
71. Water is pumped from a fully penetrating well of radius  $0.2\text{ m}$  at a constant rate of  $400\text{ m}^3/\text{hour}$  from a confined sandy aquifer of thickness  $40\text{ m}$  and porosity  $0.25$ . For a macroscopic flow velocity, the time taken by the pollutant to travel with ground water from a distance of  $100\text{ m}$  to the well will be:
- $3.84\text{ day}$
  - $3.14\text{ day}$
  - $2.84\text{ day}$
  - $2.14\text{ day}$
72. Consider following operating data for conventional activated sludge treatment plant:
- $$MLSS = MLVSS$$
- |                              |   |                                     |
|------------------------------|---|-------------------------------------|
| Waste water flow             | = | $50,000\frac{\text{m}^3}{\text{d}}$ |
| Volume of Aeration tank      | = | $15,500\text{ m}^3$                 |
| Influent <i>BOD</i>          | = | $200\text{ mg/l}$                   |
| <i>MLSS</i> in Aeration tank | = | $3,000\text{ mg/l}$                 |
- F/M (Food/ Micro-organism) ratio will be:
- $0.215\text{ kg BOD/day/kg of MLSS}$
  - $0.335\text{ kg BOD/day/kg of MLSS}$
  - $0.455\text{ kg BOD/day/kg of MLSS}$
  - $0.575\text{ kg BOD/day/kg of MLSS}$

73. Which one of the following groups represents secondary air pollutants?
- (a) Ozone, Formaldehyde, Peroxy-acetyl-nitrate, and Halogen compounds
  - (b) Formaldehyde, Hydrocarbon, Ozone and Photochemical smog
  - (c) Ozone, Acid mist, Formaldehyde and Photochemical smog
  - (d) Formaldehyde, Acid mists, Hydrocarbon and Photochemical smog
74. Consider the following statements with reference to stability of atmosphere:
- 1. Air stability is dependent directly on the environmental lapse rate
  - 2. If environmental lapse rate is less than the adiabatic lapse rate, stability occurs

Which of the above statements is/are correct?

- (a) 1 only
  - (b) 2 only
  - (c) Both 1 and 2
  - (d) Neither 1 nor 2
75. The mass specific gravity of a fully saturated specimen of clay having a water content of 36 % is 1.86. On oven drying, the mass specific gravity drops to 1.72. The specific gravity of clay will be:
- (a) 1.42
  - (b) 1.89
  - (c) 2.24
  - (d) 2.69

76. The porosity of a soil sample is 35 % and the specific gravity of soil particles is 2.7. The submerged unit weight of the soil will be nearly:

- (a)  $8.6 \text{ kN/m}^3$
- (b)  $10.8 \text{ kN/m}^3$
- (c)  $16.8 \text{ kN/m}^3$
- (d)  $20.6 \text{ kN/m}^3$

77. A sample of dry sand is subjected to a triaxial test. The angle of internal friction is  $37^\circ$ . If the minor principal stress is  $200 \text{ kN/m}^2$ , the major stress at the failure will be nearly:

- (a)  $606.6 \text{ kN/m}^2$
- (b)  $764.4 \text{ kN/m}^2$
- (c)  $804.6 \text{ kN/m}^2$
- (d)  $964.4 \text{ kN/m}^2$

78. Consider the following results regarding a lateral pressure in a triaxial compression test on a cohesive soil:

$$\begin{aligned} \text{Angle of shearing resistance } \varphi &= 17.5^\circ \\ \text{Cohesion} &= 3.0 \text{ kg/cm}^2 \\ \text{Total axial stress at failure} &= 18 \text{ kg/cm}^2 \end{aligned}$$

The lateral pressure will be nearly:

- (a)  $6.9 \text{ kg/cm}^2$
- (b)  $5.7 \text{ kg/cm}^2$
- (c)  $4.5 \text{ kg/cm}^2$
- (d)  $5.3 \text{ kg/cm}^2$

79. Due to a rise of temperature, the viscosity and unit weight of the percolating fluid are reduced to 75 % and 97 % respectively. Other things being constant, the percentage change in coefficient of permeability will be:
- (a) 26.5 %
  - (b) 29.5 %
  - (c) 33.5 %
  - (d) 37.5 %
80. The intensity of vertical pressure at a point 4 m directly below a 20 kN point load acting at a horizontal ground surface will be nearly:
- (a)  $0.2 \text{ kN/m}^2$
  - (b)  $0.4 \text{ kN/m}^2$
  - (c)  $0.6 \text{ kN/m}^2$
  - (d)  $0.8 \text{ kN/m}^2$
81. A rectangular footing  $2 \text{ m} \times 3 \text{ m}$  carries a column load of 600 kN at a depth of 1 m. The footing rests on a  $c - \phi$  soil strata 6 m thick, having Poisson's ratio of 0.25 and Young's modulus of elasticity is  $20,000 \text{ kN/m}^2$ . The immediate elastic settlement of the footing will be: (Given  $I_\omega = 1.06$ )
- (a) 7.64 mm
  - (b) 9.94 mm
  - (c) 12.62 mm
  - (d) 15.92 mm

82. A 30 cm square bearing plate settles 8 mm in a plate load test on cohesionless soil when the intensity of loading is  $180 \text{ kN/m}^2$ . The settlement of the shallow foundation of 1.5 m square under the same intensity of loading will be nearly:
- (a) 22.2 mm
  - (b) 24.6 mm
  - (c) 26.6 mm
  - (d) 28.2 mm
83. The earth pressure distribution in sand for braced cuts of moist and dry sands is:
- (a)  $0.45 \gamma_D K_a$
  - (b)  $0.65 \gamma_D K_a$
  - (c)  $0.75 \gamma_D K_a$
  - (d)  $0.85 \gamma_D K_a$
84. Which one of the following surveys is conducted for public land system to delineate and establish boundaries of field, houses or other private or public property?
- (a) Topographic survey
  - (b) Engineering survey
  - (c) Cadastral survey
  - (d) Control survey

85. An old map was drawn to a scale of  $1\text{ cm} = 10\text{ m}$ . The field was surveyed with a  $30\text{ m}$  chain which was actually  $5\text{ cm}$  too long. An original length of  $10\text{ cm}$  now shrunk to  $9.75\text{ cm}$  on plan. If the plan area measured with a planimeter is  $97.03\text{ cm}^2$ , the actual area of land will be:
- (a)  $13,624\text{ m}^2$
  - (b)  $12,484\text{ m}^2$
  - (c)  $11,842\text{ m}^2$
  - (d)  $10,241\text{ m}^2$
86. Which one of the following types of keys is arranged Air-photo interpretation so that the interpretation proceeds step-by-step from the general to the specific, and leads to the elimination of all features or conditions except the one being identified?
- (a) Imaginary key
  - (b) Elimination key
  - (c) Stereoscopic key
  - (d) Photo key
87. Human eye is sensitive only to visible spectrum which is in the wavelength range of:
- (a)  $0.2\text{ to }05\ \mu\text{m}$
  - (b)  $0.4\text{ to }07\ \mu\text{m}$
  - (c)  $0.6\text{ to }09\ \mu\text{m}$
  - (d)  $0.8\text{ to }12\ \mu\text{m}$

88. Which of the following stakes are set at points that have the same ground and grade elevation?
- (a) Offset stakes
  - (b) Slope stakes
  - (c) Centre-line stakes
  - (d) Grade stakes
89. Which one of the following is an ideal transition curve?
- (a) Cubic spiral
  - (b) Cubic parabola
  - (c) Lemniscate
  - (d) Clothoid
90. Which one of the following types of lustre is exhibited by 'calcite'?
- (a) Vitreous lustre
  - (b) Dull
  - (c) Pearly
  - (d) Resinous
91. Which one of the following minerals is softest?
- (a) Calcite
  - (b) Apatite
  - (c) Orthoclase
  - (d) Gypsum

92. 'Granites' generally show three sets of joints mutually at right angles which divide the rock mass into more or less cubical blocks, such joints are called:
- (a) Master joints
  - (b) Sheet joints
  - (c) Columnar joints
  - (d) Mural joints
93. The radius of a horizontal circular curve is  $100\text{ m}$ . The design speed is  $50\text{ kmph}$  and design coefficient of lateral friction is  $0.15$ . The superelevation rate required if full lateral friction is assumed to develop will be:
- (a) 1 in 24.7
  - (b) 1 in 21.2
  - (c) 1 in 18.7
  - (d) 1 in 14.2

94. If,

$e$  = superelevation in meters

$f$  = coefficient of lateral friction between tyres and road surface

$v$  = design speed for the road in meters/second

$R$  = radius of curve in meters

The relation between super elevation, coefficient of lateral friction, the design speed and radius of curvature of the road is given by the equation:

(a)  $\frac{v^2}{2g} + e - f = 0$

(b)  $e + f - \frac{v^2}{2g} = \frac{v^2}{gR}$

(c)  $e + c = f - \frac{v^2}{gR}$

(d)  $e + f = \frac{v^2}{gR}$

95. The superelevation required at a horizontal curve of radius 300 m, for a design speed of 80 km/hr and coefficient of lateral friction of 0.15 will be nearly:

(a) 1 in 55.6

(b) 1 in 50.4

(c) 1 in 48.6

(d) 1 in 42.6

96. The natural method of ventilation for tunneling is conveniently used when:

(a) A drift is not driven from portal to portal

(b) Diameter of the tunnel is large but its length is small

(c) Tunnel is not to be laid in the direction of wind

(d) Blowing and exhausting is not done

97. Which one of the following method is adopted as temporary drainage system for tunnel?
- (a) Open-ditch drainage system
  - (b) By providing a central drain
  - (c) By providing iron shed along with side drains
  - (d) By providing a side drain
98. Which one of the following is *not* an important feature of Tube Railways?
- (a) The railway stations have to be of cubical form
  - (b) Escalators or moving stair cases are to be constructed to reach the tube railways
  - (c) Only electric traction is to be used to avoid the smoke and ventilation problems
  - (d) Automatic signaling system is to be used
99. In the design of curve for Railway track the Bernoulli's equation for lemniscate is:
- (a)  $L = 0.073 D \times V_{max}$
  - (b)  $L = 4.4 \sqrt{R}$
  - (c)  $L = \frac{3.28 V^2}{R}$
  - (d)  $L = m. \sqrt{\sin 2\alpha}$

100. Which one of the following signal system in Railway signals does *not* fall under the classification of signals according to their functional characteristics?

- (a) Stop or semaphore type of signals
- (b) Hand signals
- (c) Warner signals
- (d) Shunting signals



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