

# CIVIL ENGINEERING

## SECTION-I

### QUESTION NUMBER 1-20

#### CARRY 1 MARK EACH

1. A brick laid with its length across the wall is known as a
  - a. stretcher
  - b. header
  - c. closer
  - d. bat
2. Which of the following is not a mobile crane type?
  - a. Bottom slewing tower crane
  - b. Telescopic-boom truck mounted crane
  - c. Crawler crane
  - d. Lattice-boom truck mounted crane
3. A principal plane is a plane of
  - a. minimum tensile stress
  - b. maximum tensile stress
  - c. maximum shear stress
  - d. zero shear stress
4. (i) Rapid hardening Portland cement is used in mass concrete construction for lowering the heat of hydration.  
(ii) Rapid hardening Portland cement is blended cement.  
Which of the following option is correct?
  - a. (i) is false and (ii) is true
  - b. (i) is true and (ii) is false
  - c. Both (i) and (ii) are false
  - d. Both (i) and (ii) are true
5. Which of the following statement is true?
  - a. The nominal dimension of a brick is greater than its specified dimension by thickness of the mortar joint.
  - b. The nominal dimension of a brick is less than its specified dimension by thickness of the mortar joint.
  - c. The nominal dimension of a brick is equal to its specified dimension.
  - d. The nominal dimension of a brick is less than its specified dimension by twice the thickness of the mortar joint.
6. Which of the following equipment is used primarily to excavate below the natural ground surface on which it rests?
  - a. Dozer
  - b. Scraper
  - c. Hoe
  - d. Jaw crusher
7. The phenomenon in which, some of the water in the mix tends to rise to the surface of freshly placed concrete is known as
  - a. flash set
  - b. bleeding
  - c. setting
  - d. hydration
8. In a network diagram, the early start time of an activity is
  - a. the minimum of the late finish times of all its immediate predecessors
  - b. the minimum of the early finish times of all its immediate predecessors
  - c. the maximum of the late finish times of all its immediate predecessors
  - d. the maximum of the early finish times of all its immediate predecessors
9. Which of the following compound is most widely used as accelerating admixture in concrete?
  - a. Sugar
  - b. Calcium chloride
  - c. Soluble zinc salts
  - d. Synthetic detergents
10. Which method of compaction is appropriate for sand?
  - a. Impact
  - b. Pressure
  - c. Vibration
  - d. Kneading

11. Partial safety factor for concrete and steel in limit state method of design of RC structures are assumed as
- 1.35 and 1.2 respectively
  - 1.14 and 1.25 respectively
  - 1.08 and 1.25 respectively
  - 1.5 and 1.15 respectively
12. Which of the following is not a soft wood?
- Oak
  - Fir
  - Pine
  - Spruce
13. In a network diagram, the total float of an activity is equal to
- (Late finish time) — (Late start time)
  - (Late finish time) — (Early finish time)
  - (Early finish time) — (Early start time)
  - (Late start time) — (Early finish time)
14. As per IS 456 : 2000, the maximum spacing of steel bars in a reinforced concrete solid slab is
- 300 mm
  - 450 mm
  - 3 times effective depth or 300mm whichever is less
  - 3 times the effective depth
15. Which of the following is fly ash based blended cement?
- Portland slag cement
  - Low-heat Portland cement
  - Portland pozzolana cement
  - Ordinary Portland cement
16. Which of the following test is performed on hardened concrete to assess the hardness of its surface?
- Rebound hammer test
  - Rebound hammer test
  - Initial surface absorption test
  - Flexural test
17. In a PERT network, the optimistic time, pessimistic time and most likely time of an activity are 4 days, 16 days and 7 days respectively. What is the value of the expected duration of the activity?
- 27 days
  - 8 days
  - 12 days
  - 19 days
18. (i) The addition of fly ash in concrete lowers the heat of hydration in concrete.  
(ii) The addition of fly ash in concrete reduces its permeability. Which of the following option is correct?
- (i) is false and (ii) is true
  - (i) is true and (ii) is false
  - Both (i) and (ii) are false
  - Both (i) and (ii) are true
19. The crack resulting in lengthwise separation of wood, occurring between and parallel to annual rings is known as
- check
  - knot
  - split
  - shake
20. Which of the following compound is mainly responsible for the early strength development of hydrated Portland cement?
- C<sub>3</sub>S
  - C<sub>2</sub>S
  - C<sub>3</sub>A
  - C<sub>4</sub>AF

QUESTION NUMBER 21-50

CARRY 2 MARKS EACH

21. A cantilever beam of length  $l$  and flexural rigidity  $EI$  is subjected to a clockwise couple  $M_0$  at the free end. The downward deflection at the free end will be
- $\frac{M_0 l^2}{2EI}$
  - $\frac{M_0 l^2}{4EI}$
  - $\frac{M_0 l^2}{6EI}$
  - $\frac{M_0 l^2}{8EI}$
22. A simply supported beam of span  $L$  carries two vertical point loads  $W$  at  $L/3$  from both

ends. The equivalent uniformly distributed load to produce same maximum bending moment as that of the two concentrated loads on the beam is

- $4W/L$
- $3W/8$
- $8W/3L$
- $4W/3L$

23. A beam simply supported at the ends carries uniformly distributed load throughout the span. The depth/breadth ratio is 2: 1. Now the same beam is used without any modification cross sectional area to carry the same uniformly distributed load but with depth/breadth ratio of 1:2. The ratio of maximum deflection of the first case to the second case is

- 1:4
- 1:2
- 2:1
- 4:1

24. A pin jointed truss as shown below is formed by two members. The length of inclined member is  $L$  and angle between the members meeting at the joint is  $30^\circ$ . The modulus of elasticity and cross sectional area of two members are same and equal to  $E$  and  $A$ , respectively. The vertical deflection of the joint under load  $P$  is given by

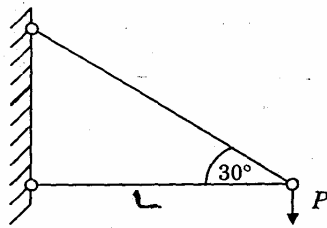


Fig.I-Q24

- $\frac{PL}{2AE} (8+3\sqrt{3})$
- $\frac{PL}{4AE} (8+3\sqrt{3})$
- $\frac{PL}{2AE} (4+3\sqrt{3})$
- $\frac{PL}{4AE} (2+3\sqrt{3})$

25. A two span continuous beam ABC ( $AB = BC$ ) is fixed at A and freely supported at B and C. A uniformly distributed load is applied in the span BC. The flexural rigidities of two spans are equal and supports

are at the same level. If  $M_A$  and  $M_B$  are the moments at supports A and B respectively, which of the following relationships is correct?

- $M_A = M_B$
- $M_A = -2M_B$
- $M_A = 0.5M_B$
- $M_A = -0.5M_B$

26. A concrete beam of rectangular section of  $300 \text{ mm} \times 500 \text{ mm}$  is prestressed with  $750 \text{ kN}$  force, the centre of prestressing steel being  $100 \text{ mm}$  from the centroid of cross section. The moment of inertia of the cross section about horizontal axis passing through the centroid and area of the cross section are  $3.125 \times 10^9 \text{ mm}^4$  and  $1.5 \times 10^5 \text{ mm}^2$  respectively. Neglecting the effect of self weight, the stresses at top and bottom fibres are

- $5 \text{ MPa}$  (compressive) and  $12 \text{ MPa}$  (compressive) respectively
- $3.4 \text{ MPa}$  (tensile) and  $12 \text{ MPa}$  (compressive) respectively
- $1 \text{ MPa}$  (tensile) and  $11 \text{ MPa}$  (compressive) respectively
- $2.5 \text{ MPa}$  (tensile) and  $14.5 \text{ MPa}$  (compressive) respectively

27. In a two dimensional state of stress, direct stresses in x and y direction are  $+90 \text{ MPa}$  and  $+40 \text{ MPa}$ , and shear stress of  $-30 \text{ MPa}$ . If Mohr's circle is drawn with scale of  $1 \text{ cm} = 10 \text{ MPa}$ , then centre of Mohr's circle from the origin is located at a distance of

- $3.5 \text{ cm}$
- $4.5 \text{ cm}$
- $7.5 \text{ cm}$
- $6.5 \text{ cm}$

28. A propped cantilever is of length  $6 \text{ m}$ . The flexural rigidity of the beam is  $10000 \text{ kN.m}^2$ . If the propped end undergoes a settlement of  $12 \text{ mm}$ , then magnitude of the moment induced at the fixed end is

- $20 \text{ kN.m}$
- $16 \text{ kN.m}$
- $10 \text{ kN.m}$
- $0$

29. Plastic moment carrying capacity of a rectangular section of width  $b$  and depth  $d$  is  $M_p$ . If  $f_y$  is the yield stress of the material, then depth of the section will be given by

- a.  $\sqrt{\frac{3M_p}{2bf_y}}$
- b.  $\sqrt{\frac{6M_p}{bf_y}}$
- c.  $\sqrt{\frac{4M_p}{3f_y}}$
- d.  $\sqrt{\frac{4M_p}{bf_y}}$

30. A beam of total length L is fixed at both the ends. There are two internal hinges; each is at one third of the span from either end. The beam carries uniformly distributed load w per m run throughout the entire span. The bending moment at the fixed support is

- a.  $\frac{wL^2}{7}$
- b.  $\frac{wL^2}{9}$
- c.  $\frac{wL^2}{10}$
- d.  $\frac{wL^2}{12}$

31. A built up section of a steel beam is shown below. The centroid of the section is 117 mm from the top fibre. If moment of inertia of the section about centroidal horizontal axis is  $6.48 \times 10^6 \text{ mm}^4$  and permissible stress in bending is 165 MPa, then safe load that beam can carry over a simply supported span of 4 m is

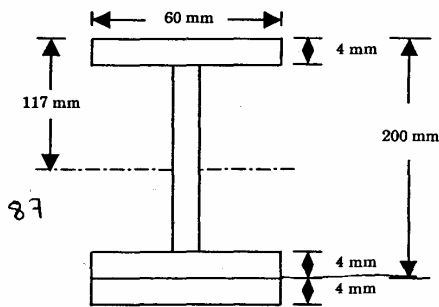


Fig.I-Q31

- a. 21.4 kN
- b. 14.3 kN
- c. 16.4 kN
- d. 18.3 kN

32. Deflection of a simply supported beam of span L and flexural rigidity EI at a distance of x from the left hand support is given by  $y(x) = \frac{A_0}{EI} \sin \frac{\pi x}{L}$ , where  $A_0$  is a constant. The distributed loading on the beam will be

- a.  $\frac{A_0 \pi^2}{L^2} \sin \frac{\pi x}{L}$
- b.  $\frac{A_0 \pi^3}{L^4} \cos \frac{\pi x}{L}$
- c.  $\frac{A_0 \pi^3}{L^3} \cos \frac{\pi x}{L}$
- d.  $\frac{A_0 \pi^4}{L^4} \sin \frac{\pi x}{L}$

33. A sample of coarse aggregate has the following information:

Weight of oven dry sample = 565 gin, weight of wet (moist) sample = 600 gm, weight of sample in saturated surface dry condition = 580 gm. What are the values of water absorption (%) and free moisture content (%)?

- a. 2.65% and 3.54% respectively
- b. 3.54% and 2.65% respectively
- c. 3.33% and 2.5% respectively
- d. 2.5% and 3.33% respectively

34. For a concrete mix of  $1 \text{ m}^3$ , the water, coarse aggregate and fine aggregate contents are 200 kg, 1200 kg and 600 kg respectively. The water to cement ratio (w/c ratio) by mass is 0.50. If the coarse aggregate to cement ratio by mass is reduced by 0.5 and the coarse aggregate content is reduced by 50 kg from their respective original values, what is the new w/c ratio keeping in view that the fine aggregate content and the total quantity of all ingredients remain same in both cases?

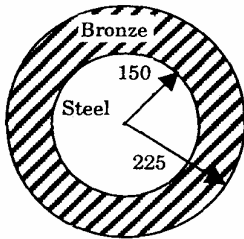
- a. 0.61
- b. 0.41
- c. 0.31
- d. 0.51

35. What is the ratio of target mean compressive strength at 28 days of M 25 grade of concrete to that of M 20 grade of concrete?

Given, s = standard deviation =  $4 \text{ N/mm}^2$ , t = a statistical value, corresponding to 5% of test results below the characteristic compressive strength = 1.65.

- a. 1.25

- b. 1.37  
c. 1.18  
d. 0.8
36. The split-tension test is conducted on a concrete cylinder of length 0.3 m and diameter 0.15 m. The maximum load applied to the specimen is 200 kN. What is the value of split tensile strength?
- a.  $2.83 \text{ N/mm}^2$   
b.  $1.41 \text{ N/mm}^2$   
c.  $5.66 \text{ N/mm}^2$   
d.  $4.24 \text{ N/mm}^2$
37. A thin cylindrical shell of inside diameter  $D$  is subjected to an internal fluid pressure  $q$ . If  $f_y$  is the yield stress of the material of the cylinder, the minimum thickness of the shell according to maximum shear stress criteria will be
- a.  $\frac{qD}{2f_y}$   
b.  $\frac{qD}{4f_y}$   
c.  $\frac{qD}{8f_y}$   
d.  $\frac{qD}{\sqrt{3}f_y}$
38. A bronze sleeve 450 mm external diameter fits accurately over a steel rod of solid circular section 300 mm in diameter as shown in the adjacent figure. If the ratio of modulus of elasticity of steel to bronze is 1.75, then the ratio of maximum flexural stress of steel bar to that of bronze sleeve will be



(All dimension are in mm)

- a.  $7/6$   
b.  $6/7$   
c.  $21/8$   
d.  $8/21$
39. A two span continuous beam AB and BC was subjected to concentrated load of 20 kN at

middle of span BC. The deflection under the load was 0.02 m (downward) and that in the middle of the span AB was 0.01 m (upward). When 16 kN and 40 kN loads are applied simultaneously at the middle of the span AB and BC respectively, then downward deflection at the middle of span BC will be

- a. 0.016 m  
b. 0.032 m  
c. 0.064 m  
d. 0.08 m
40. A solid circular shaft (length  $L$ ) is fixed at one end and free at the other is subjected to uniform torque  $T$  and bending moment  $M$  along its length. If Poisson's ratio of the material is 0.25, strain energy of the shaft can be expressed as
- a.  $\frac{L}{2EI} [M^2 + 2.25T^2]$   
b.  $\frac{L}{2EI} [M^2 + 0.8T^2]$   
c.  $\frac{L}{2EI} [M^2 + 1.25T^2]$   
d.  $\frac{L}{2EI} [M^2 + 0.4T^2]$
41. A beam of rectangular cross section is to be made from a cylindrical log of wood of diameter  $D$ . The strongest cross section of the rectangular beam that can be made should have dimension
- a.  $\frac{D}{\sqrt{2}} \times \frac{2}{\sqrt{3}} D$   
b.  $\frac{D}{\sqrt{3}} \times \sqrt{\frac{2}{3}} D$   
c.  $\frac{D}{\sqrt{2}} \times \sqrt{\frac{2}{3}} D$   
d.  $\frac{D}{\sqrt{3}} \times \frac{2}{\sqrt{5}} D$
42. A plane rigid jointed steel frame with fixed supports is acted upon by a couple  $M$  as shown below. In order to find moment induced at the fixed supports, moment distribution was carried out. The ratio of moment at support A to that at B is

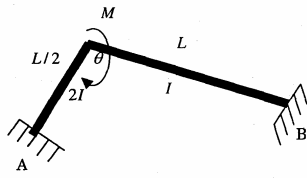


Fig. I-Q42

- a. 1:2  
b. 2:1  
c. 1:4  
d. 4:1
43. A propped cantilever of span  $3L$  is having plastic moment carrying capacity  $M_p$ . It carries a concentrated load at a distance of  $L$  from the fixed end. Collapse load for the beam is
- a.  $\frac{2M_p}{L}$   
b.  $\frac{M_p}{L}$   
c.  $\frac{2.5M_p}{L}$   
d.  $\frac{1.5M_p}{L}$
44. In a RC beam of rectangular cross section (breadth = 200 mm; effective depth = 350 mm), vertical stirrups 2-legged 8 mm diameter are provided at a spacing of 200 mm c/c. Given, cross sectional area of 8 mm bar (Fe 415) = 50.3 mm<sup>2</sup>, and design shear strength of concrete is 0.5 MPa, total shear capacity of the section will be
- a. 64.68 kN  
b. 72.45 kN  
c. 115.38 kN  
d. 98.56 kN
45. A beam of length  $L$  is fixed at both ends. The beam carries uniformly distributed load of intensity  $w$  per unit length covering the entire span. The points of contra-flexure are at
- a.  $\frac{L}{2} - \frac{L}{7}$  3 from both ends  
b.  $\frac{L}{2} - \frac{L}{6}$  3 from both ends  
c.  $\frac{L}{2} - \frac{L}{8}$  3 from both ends  
d.  $\frac{L}{2} - \frac{L}{9}\sqrt{3}$  from both ends
46. A steel column of hollow circular cross section (external diameter =  $D$  and internal diameter =  $d$ ) hinged at both ends is subjected to compressive load. If the length of the column is  $L$  and modulus of elasticity of steel is  $E$ , the critical stress of column according to Euler's formula will be
- a.  $\frac{\pi^2 E}{64L^2} (D^2 + d^2)$   
b.  $\frac{\pi^2 E}{32L^2} (D^2 + d^2)$   
c.  $\frac{\pi^2 E}{8L^2} (D^2 + d^2)$   
d.  $\frac{\pi^2 E}{16L^2} (D^2 + d^2)$
47. A rivet of 20 mm diameter is used to connect 10 mm thick plate. The permissible stress for rivet in shear and bearing are 80 MPa and 250 MPa, respectively. The difference of Rivet value in double and single shear is
- a. 29044 N  
b. 26875 N  
c. 24706 N  
d. 23868 N
48. A semi circular arch of radius  $R$  hinged at two ends and at the crown carries uniformly distributed load  $q$  per unit length. The normal thrust at the crown will be
- a.  $qR/2$   
b.  $qR/4$   
c.  $qR/8$   
d.  $qR$
49. The effective length of fillet welded joint is 210 mm. If the size of the weld is 6 mm and permissible stress is 108 MPa, the safe load that the joint can transmit is
- a. 95256 N  
b. 85256 N  
c. 78206 N  
d. 108000 N
50. The ratio of maximum shear stress to average shear stress in a solid circular cross section is
- a. 1.11  
b. 1.22  
c. 1.33  
d. 1.44

## SECTION-II

## QUESTION NUMBER 1-20

## CARRY 1-MARK EACH

1. As per USCS classification, the diameter of silt size particle is less than
  - a. 0.075 mm
  - b. 0.002 mm
  - c. 0.02 mm
  - d. 0.75 mm
2. Specific volume of soil is 1.9. Its porosity is
  - a. 0.9
  - b. 0.47
  - c. 2.11
  - d. 1
3. In compaction test, MDD stands for maximum dry density and OMC for optimum moisture content. As compaction energy increases,
  - a. Both MDD and OMC increases
  - b. MDD decreases and OMC increases
  - c. MDD increases and OMC decreases
  - d. No change in MDD and OMC
4. Let ' $\tau$ ' represent shear strength,  $c$  cohesion, ' $\sigma'$ ' effective normal stress and  $\phi$  angle of internal friction, then according to Coulomb's shear strength model
  - a.  $\tau = \sigma' + c \tan \phi$
  - b.  $\sigma' = \tau + c \tan \phi$
  - c.  $\sigma' = c + \tau \tan \phi$
  - d.  $\tau = c + \sigma' \tan \phi$
5. The bearing capacity of soil supporting a footing of size 3 m x 3 m will not be affected by the presence of water table located at a minimum depth below the base of footing by
  - a. 1.0 m
  - b. 1.5 m
  - c. 3.0 m
  - d. 6.0 m
6. Parallax error in leveling is due to a condition where
  - a. image formed by objective is in the plane of cross hair
  - b. image formed by objective is not in the plane of cross hair
  - c. image formed by eye piece is in the plane of cross hair
  - d. image formed by eye piece is not in the plane of cross hair
7. Sag correction is applicable while using
  - a. dumpy level on a sloping ground
  - b. plane table by two point problem
  - c. tape for linear measurement
  - d. theodolite for measuring height
8. Which of the following tests is not conducted on bituminous material?
  - a. Penetration test
  - b. Viscosity test
  - c. Vebe test
  - d. Softening point test
9. What is the value of radius of relative stiffness for a 250 mm thick cement concrete slab resting on a subgrade? Given, Poisson's ratio of concrete = 0.15, modulus of elasticity of concrete = 26950 N/mm<sup>2</sup> and modulus of subgrade reaction equal to 0.064 N/mm<sup>2</sup>.
  - a. 2996 mm
  - b. 675 mm
  - c. 1309 mm
  - d. 865 mm
10. Fish plates are used
  - a. in rail joints for maintaining the continuity of rails
  - b. for joining cast iron sleepers with rails
  - c. for joining prestressed concrete sleepers with rails
  - d. to divert train from one track to another
11. To avoid tension on the bottom of a gravity dam of bottom width  $b$ , the eccentricity must be less than
  - a.  $b/2$
  - b.  $b/3$
  - c.  $2b/3$
  - d.  $b/6$
12. A channel with a mild slope is followed by a steep bottom slope. The profile of the gradually varied flow will be
  - a. M1-S2
  - b. M2-S2
  - c. M1-S1
  - d. M2-S1
13. Identity the True statement from the following:
  - a. A reciprocating pump will be called double acting reciprocating pump if it has two cylinders.
  - b. A reciprocating pump will be called double acting reciprocating pump if it has two pistons.
  - c. In case of double acting reciprocating pump, the liquid is in contact with one side of the piston.
  - d. In case of double acting reciprocating pump, the liquid is in contact with both sides of the piston.
14. Flood routing is a procedure to determine
  - a. Time and magnitude of flow at a point on a water course from known upstream hydrograph
  - b. The discharge over the spillway and through sluice gate
  - c. Reservoir storage
  - d. The head available at the power plant
15. Ideal fluids are those fluids which
  - a. Have no viscosity
  - b. Have viscosity
  - c. Have surface tension

- d. Are compressible
16. Hygroscopic water is a film water chemically bound to soil particles by adhesive force and
- Is available to plants
  - Is not available to plants
  - Can be drained out by plants
  - Is capable of movement by capillary force
17. Modern turbidimeters, working on the principle of “scattering of light”, are known as
- Optimeters
  - Tintometers
  - Nephelometers
  - pH meter
18. Pollution by depletion of ozone layer, threatening the environment, is caused due to the reaction of ozone with
- Carbon Monoxide
  - Chlorofluorocarbon (CFC)
  - Sulfur dioxide
  - Oxygen
19. The water to be used for boilers should preferably be
- Hard
  - Potable
  - Corrosive
  - Soft
20. If  $Q$  is the flow rate of water into a rectangular sedimentation tank of length  $L$ , width  $B$  and height  $H$ , then the surface loading rate is given by
- $\frac{Q}{B.L}$
  - $\frac{Q}{B.H}$
  - $\frac{Q}{B.L.H}$
  - $\frac{Q}{B.L.H}$

## QUESTION NUMBER 21-50

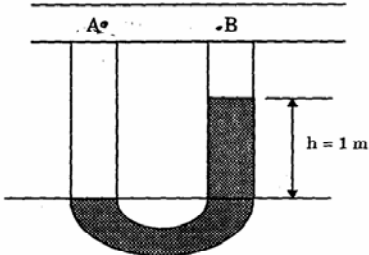
## CARRY 2 MARKS EACH

21. A soil sample of specific gravity 2.7 has void ratio of 0.9. The gravimetric water content of the sample is 25%. Its bulk unit weight is
- $13.9 \text{ kN/m}^3$
  - $17.4 \text{ kN/m}^3$
  - $18.6 \text{ kN/m}^3$
  - $8.8 \text{ kN/m}^3$
22. A bulk weight of 200 g of silty soil of specific gravity 2.64 is packed in a volume of 115 cc. Oven dried weight of soil is 170g. The saturation of the sample is
- 25%
  - 30%
  - 75%
  - 60%
23. For a falling head permeability test, there is a drop in head from 64 cm to 54 cm in 8 minutes. The area of stand pipe is  $1 \text{ cm}^2$  and area of soil sample is  $20 \text{ cm}^2$ . Length of soil sample is 10 cm. The permeability of the soil sample is
- $1.8 \times 10^{-4} \text{ cm/s}$
  - $1.4 \times 10^{-1} \text{ cm/s}$
  - $4.1 \times 10^{-1} \text{ cm/s}$
  - $1.8 \times 10^{-3} \text{ cm/s}$
24. A 30 cm diameter concrete pile is driven into a homogenous clay deposit with cohesion equal to  $40 \text{ kN/m}^2$  and adhesion factor equal to 0.7. Embedded length of the pile is 10 m and safe load on the pile is 115 kN. Assume  $N_c$  equal to 9 and there is both end resistance and shaft resistance. The factor of safety is
- 2.3
  - 0.4
  - 1.2
  - 2.5
25. Sea bed is 200 m deep, which consist of sand with saturated unit weight of  $19.81 \text{ kN/m}^3$ . Unit weight is  $9.81 \text{ kN/m}^3$ . Effective stress at 5m below sea bed is
- $2061 \text{ kN/m}^2$
  - $50 \text{ kN/m}^2$
  - $99 \text{ kN/m}^2$
  - $2012 \text{ kN/m}^2$
26. Coefficient of consolidation for a clay layer is given as  $6 \times 10^{-7} \text{ m}^2/\text{minute}$ . The time factor for 90% degree of consolidation is 0.848. Liquid limit of clay is 50%. The saturated clay layer is 3m thick with double drainage condition. The time required for 90% consolidation is
- $5.3 \times 10^4 \text{ hours}$
  - $2.12 \times 10^5 \text{ hours}$
  - $2.65 \times 10^4 \text{ hours}$
  - $1.06 \times 10^5 \text{ hours}$
27. For an unconsolidated undrained (UU) test, major and minor principal stress for silty clay is  $200 \text{ kN/m}^2$  and  $100 \text{ kN/m}^2$ , respectively. Shear strength parameters for this soil sample is
- $c = 200 \text{ kN/m}^2 ; \phi = 20^\circ$
  - $c = 100 \text{ kN/m}^2 ; \phi = 0^\circ$
  - $c = 50 \text{ kN/m}^2 ; \phi = 0^\circ$
  - $c = 200 \text{ kN/m}^2 ; \phi = 10^\circ$
28. A vertical cut is made in a soil with shear strength parameters of  $c' = 0$  and  $\phi' = 12^\circ$ . Coefficient of active earth pressure is 0.656. Unit weight of soil is  $18 \text{ kN/m}^3$ . The active earth pressure at 4m depth is
- $47 \text{ kN/m}^2$



- b.  $3 \text{ kN/m}^2$   
 c.  $72 \text{ kN/m}^2$   
 d.  $110 \text{ kN/m}^2$
29. A 10m thick clay layer with unit weight of  $20 \text{ kN/m}^3$  overlies sandy deposit of 4m thick. The piezometric head at the bottom of the clay layer is 18m. The safe depth of excavation possible in clay layer without causing instability is  
 a. 8.8 m  
 b. 6.1 m  
 c. 4.9 m  
 d. 1.2 m
30. The following bearings were observed in running a closed traverse by compass survey.
- | Line | Fore bearing    | Back bearing    |
|------|-----------------|-----------------|
| ab   | $75^\circ 5'$   | $254^\circ 20'$ |
| bc   | $115^\circ 20'$ | $296^\circ 35'$ |
| cd   | $165^\circ 35'$ | $345^\circ 35'$ |
- Local attraction problem exists at stations:  
 a. c  
 b. d  
 c. a, b  
 d. All stations
31. A theodolite was set up at station P and angle of elevation measured to a vane 4 m above the foot of leveling staff held at Q is  $9^\circ$ . Horizontal distance between P and Q is 2000 m. Reduced level of instrument axis is 2650 m. Assuming negligible correction, the level of staff station Q is  
 a. 2654 m  
 b. 2967 m  
 c. 2963 m  
 d. 2650 m
32. Reduced level of bottom of sunshade, 'a' is 63.120 m. The following readings were obtained using a level:  
 Readings on inverted staff at 'a' is 2.235m  
 Readings on the top of peg 'p' on the ground is 1.035 m  
 The height difference between a and p is  
 a. 2.235 m  
 b. 1.195 m  
 c. 3.270 m  
 d. 1.035 m
33. The distance between two posts measured with a 20 m chain was found to be 250 m. If the chain 10 cm too long, then the true distance between the posts is  
 a. 251.25 m  
 b. 250.10 m  
 c. 248.75 m  
 d. 249.90 m
34. The correct sequence of the anaerobic sludge digestion steps is  
 a. Acid formation, hydrolysis, methane formation  
 b. Methane formation, acid formation, hydrolysis  
 c. Hydrolysis, methane formation, acid formation  
 d. Hydrolysis, acid formation, methane formation
35. If a sample of air is analyzed at standard temperature and pressure, and is found to contain 0.3 ppm of sulfur dioxide, the equivalent  $\text{SO}_2$  concentration in  $\mu\text{g}/\text{m}^3$  will be (Given atomic weight of S = 32g and O = 16g)  
 a. 8570  
 b. 857  
 c. 85.7  
 d. 0.857
36. Match the List I with List II and select the correct answer using the codes given below the lists:
- List I (Treatment Units)**  
 a. Grit Chamber  
 b. Primary sedimentation  
 c. Sludge digestion  
 d. Activated sludge
- List II (Detention Time)**  
 (i) Six hours  
 (ii) Two minutes  
 (iii) Two hours  
 (iv) Twenty days
- Codes
- |    | a  | b   | c   | d  |
|----|----|-----|-----|----|
| a. | i  | ii  | iii | iv |
| b. | ii | iii | iv  | i  |
| c. | i  | iv  | iii | ii |
| d. | ii | i   | iii | iv |
37. A 10 min. triangular unit hydrograph has peak discharge of  $100 \text{ m}^3/\text{sec}$  and time to peak is 30 min. the peak discharge and time to peak of the direct runoff hydrograph resulting from a 20 min. storm having 0.2 cm rainfall in the first 10 min. and 0.4 cm rainfall in the second 10 min. is (consider phi-index of 1.2 cm/hr)  
 a.  $80 \text{ m}^3/\text{sec}$  and 40 min.  
 b.  $20 \text{ m}^3/\text{sec}$  and 40 min.  
 c.  $20 \text{ m}^3/\text{sec}$  and 30 min.  
 d.  $100 \text{ m}^3/\text{sec}$  and 30 min.
38. The velocity field can be represented by  

$$V = (3x + py + qz)i + (rx + 2y + 4z)j + (sx + 6y + tz)k$$
 where p, q, r, s, t are constants. If the fluid is incompressible and conserve mass, then the value of t is  
 a. 5  
 b. -5  
 c. 3  
 d. 1
39. A channel is carrying a discharge of  $20 \text{ m}^3/\text{sec}$ . The average velocity of flow in the channel for  $f = 1$  as per Lacey's regime theory is

- a. 0.723 m/sec  
b. 7.23 m/sec  
c. 72.3 m/sec  
d. 0.0723 m/sec
40. An irrigation canal has culturable command area of 28,000 hectares. The intensity of irrigation for Kharif season is 25% and for Rabi season is 60%. If the duty at its head is 700 hectares/cumec for Kharif season and 1680 hectares/cumec for Rabi season, then the design discharge at the head of the canal is  
a. 2 cumec  
b. 20 cumec  
c. 10 cumec  
d. 200 cumec
41. A volume of  $2.0 \times 10^6 \text{ m}^3$  of groundwater was pumped out uniformly from an unconfined aquifer of  $200 \text{ km}^2$  area. If the specific yield of the aquifer is 0.005, the water table of the aquifer was lowered down by  
a. 2m  
b. 10m  
c. 8m  
d. 5m
42. A u-tube manometer is arranged as shown in figure below to measure the pressure difference between point A and point B in a pipeline conveying water of density  $1000 \text{ kg/m}^3$ . The density of the manometer fluid is  $10 \times 10^3 \text{ kg/m}^3$ . The pressure difference between A and B when  $h = 1.0 \text{ m}$  is (take  $g = 10 \text{ m/sec}^2$ )
- 
- a.  $90 \text{ kN/m}^2$   
b.  $100 \text{ kN/m}^2$   
c.  $9 \text{ kN/m}^2$   
d.  $900 \text{ kN/m}^2$
43. A rectangular channel has a width of 2m. the channel carries a discharge of  $4 \text{ m}^3/\text{sec}$  with depth of water of 1m. At certain section in the channel, it is proposed to construct a smooth hump. The maximum height of the hump that can be constructed without any change in the upstream depth of the channel is  
a. 0.9 m  
b. 1.20 m  
c. 0.09 m  
d. 1.11 m
44. Head loss between section A and B of a circular pipe of a diameter 100 mm is 0.40 m. The average velocity of flow is 1.26 m/sec and

- Darcy's frictional coefficient is 0.008. The length of the pipe between section A and B is  
a. 154.48 m  
b. 1.54 m  
c. 18.50 m  
d. 15.45 m
45. What is the population equivalent of a city if the average sewage from the city is  $95 \times 10^6$  l/day, and the average 5 day BOD is 300 mg/l? Assume that per capita BOD<sub>5</sub> of sewage per day = 0.08 kg.  
a. 2,280  
b. 28,500  
c. 71,250  
d. 3,56,250
46. The mixed liquor suspended solids (MLSS) concentration in the aeration tank of activated sludge process is 4000 mg/l. If one litre of sample settled in 30 minutes and the measuring cylinder showed a sludge volume of 200 ml, then the sludge volume index would be nearly  
a. 200  
b. 150  
c. 100  
d. 50
47. If the population of a city is 2 lakhs, and average water consumption is 200 lpcd, then the capacity of the pipe mains should be  
a. 108 Mld  
b. 72 Mld  
c. 60 Mld  
d. 40 Mld
48. For a water sample having a total hardness of 200 mg/l as  $\text{CaCO}_3$ , and alkalinity of 250 mg/l as  $\text{CaCO}_3$ , the carbonate hardness and non-carbonate hardness are respectively  
a. 50 mg/l and 200 mg/l of  $\text{CaCO}_3$   
b. 200 mg/l and 50 mg/l of  $\text{CaCO}_3$   
c. 0 mg/l and 200 mg/l of  $\text{CaCO}_3$   
d. 200 mg/l and 0 mg/l of  $\text{CaCO}_3$
49. A water having  $\text{pH} = 9$  will have  $\text{OH}^-$  concentration equal to  
a.  $10^9 \text{ mol/l}$   
b.  $10^{-9} \text{ mol/l}$   
c.  $10^{-5} \text{ mol/l}$   
d.  $10^5 \text{ mol/l}$
50. The chlorine demand of a water sample was found to be 0.2 mg/l. The amount of bleaching powder containing 30% available chlorine to be added to treat one litre of such a water sample is  
a. 0.67 mg  
b. 0.06 mg  
c. 1.33 mg  
d. 0.14 mg

SECTION - III

ALL QUESTIONS CARRY  
1MARK EACH

1. Who was the first woman to be elected as the President of the Indian National Congress?
  - a. Sarojini Naidu
  - b. Sonia Gandhi
  - c. Indira Gandhi
  - d. Annie Besant
2. Which political leader delivered the famous 'I have a dream' speech?
  - a. Jawaharlal Nehru
  - b. Winston Churchill
  - c. Martin Luther King
  - d. Rabindranath Tagore
3. Who established the organization 'Khudai Khidmatgar'?
  - a. Hyder Ali
  - b. Gopal Krishna Gokhale
  - c. Maulana Abul Kalam Azad
  - d. Khan Abdul Ghaffar Khan
4. Analgesics are drugs used to prevent or relieve
  - a. aches and pain
  - b. fever and high body temperature
  - c. hormone deficiency
  - d. stress and anxiety
5. The abbreviation CD stands for
  - a. Circular Disc
  - b. Computer Device
  - c. Compact Disc
  - d. Code-Demodulator
6. Chandrayaan-I, India's first mission to the moon, has 11 scientific instruments that are being released on the surface of the moon. These instruments are together known as
  - a. Moon Impact Probes
  - b. Terrain Mapping Cameras
  - c. Scientific Payloads
  - d. Spectrometers
7. The World Wide Web was invented by
  - a. Tim Berners-Lee
  - b. Narayanmurthy
  - c. Sabeer Bhatia
  - d. Charles Babbage
8. How many diagonals does a quadrilateral have?
  - a. one
  - b. two
  - c. four
  - d. four
9. ISO 14000 standards deal with
  - a. quality management
  - b. production management
  - c. human resource management
  - d. environmental management
10. Which Indian politician's autobiography is titled The Story of My Life?
  - a. Morarji Desai
  - b. Mahatma Gandhi
  - c. Lal Krishna Advani
  - d. Atal Behari Vajpayee
11. The phrase 'through thick and thin' means
  - a. big and small
  - b. thin and fat
  - c. large object
  - d. under all conditions
12. Picturesque means
  - a. Photogenic
  - b. Simple
  - c. Stimulating
  - d. Ugly
13. Diligent means
  - a. intelligent
  - b. energetic
  - c. modest
  - d. industrious
14. The opposite of miserly is
  - a. spendthrift
  - b. generous
  - c. liberal
  - d. charitable
15. The opposite of ingratitude is
  - a. sympathy
  - b. reward
  - c. thankfulness
  - d. stimulation

16. The appropriate missing word in the blank space in the sentence "I prefer coffee \_\_\_\_\_ tea." is
- than
  - over
  - for
  - to
17. The appropriate missing word in the blank space in the sentence "Many relatives attended him during his illness."
- of
  - on
  - for
  - with
18. The article required before the word "one-eyed" in the sentence "There was \_\_\_\_\_ one-eyed beggar by the multiplex." Is
- the
  - a
  - an
  - nil
19. The article required before the word University in the sentence "She met Professor Shah at \_\_\_\_\_ University" is
- a
  - an
  - the
  - nil
20. 'Which one is the correct sentence amongst the following sentences?
- Mr. Gupta, accompanied by his friends, were assembled on the lawns.
  - Mr. Gupta, accompanied by his friends, are assembled on the lawns.
  - Mr. Gupta, accompanied by his friends, assembled on the lawns.
  - Mr. Gupta, accompanied by his friends, have assembled on the lawns.