Roll No: ....   Date........2 5 JUN 2017

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1. The relationship between modulus of elasticity E and bulk modulus of elasticity K, when the poisson's ratio is 0.3, is

    (A)   E = K   (B)   E = 2K
    (C)   E = 1.5 K   (D)   E = 1.2 K

2. A simply supported beam of span l carries a uniformly varying load from zero at either end to w/length at the mid span. The maximum bending moment will be

    (A) $\frac{wl^2}{12}$ at mid span   (B) $\frac{wl^2}{10}$ at mid span

    (C) $\frac{wl^2}{24}$ at mid span   (D) $\frac{wl^2}{10}$ at quarter span

3. A column of 50 mm x 50 mm is fixed on the ground and carries an eccentric load of 2 kN as shown in figure. If the stress developed along the end CD is $\frac{2N}{mm^2}$, the stress along the edge AB will be
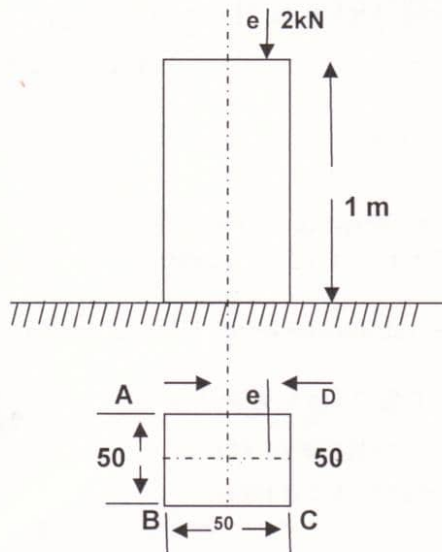
    (A) $0.8\,N/mm^2$ (B) $-0.6\,N/mm^2$
    (C) $-0.4\,N/mm^2$ (D) $-0.2\,N/mm^2$

4. A mild steel bar is in three parts each of 30 cm length. The diameters of the three parts are 1 cm, 3 cm and 4 cm respectively. The bars are subjected to an axial pull of 10 kN. If E = 2×10^5 N/mm^2 and the elongation in the three parts of the bar are Δ_1, Δ_2 and Δ_3 respectively, then the ratio of the greatest to the least elongation of these bars will be

(A)   4

(B)   3

(C)   16

(D)   9

5. A cantilever beam of span 'L' is subjected to a downward load of 800 kN uniformly distributed over its length and a concentrated upward load 'P' at its free end. For vertical displacement to be zero at the free end, the value of 'P' should be

(A)   300 kN

(B)   500 kN

(C)   800 kN

(D)   1000 kN

6. A cantilever beam 'A' with rectangular cross-section is subjected to a concentrated load at its free end. If width and depth of another beam 'B' are twice those of beam 'A', the deflection at free end of the beam 'B' to that of 'A' will be

(A)   6.25 %

(B)   14 %

(C)   23.6 %

(D)   28 %

7. A thin cylinder contains fluid at a pressure of 500 N/m^2, internal diameter of the shell is 0.6 m and tensile stress in the material is to be limited to 9000 N/m^2. The shell must have a minimum wall thickness of nearly

(A)   9 mm

(B)   11 mm

(C)   17 mm

(D)   21 mm

8. Consider the following statements
   P: the behavior of an under reinforced beam is more ductile than that of an over reinforced beam.
   Q: the over reinforced beam contains more steel and steel is more ductile than concrete.

(A)   Both P & Q are true and Q is correct explanation of P

(B)   Both P & Q are true and Q is not correct explanation of P

(C)   P is true and Q is false

(D)   P is false and Q is true

9. In a reinforced concrete retaining wall, a shear key is provided if

(A)   The retaining wall fails due to excessive shear stress in the vertical stem

(B)   The retaining wall fails in sliding check

(C)   The retaining wall fails in overturning test

(D)   The shear force in the toe slab is more than in the

10. The maximum strain in the extreme fibre in concrete and in the tensile reinforcement in a balanced section at limit state of flexure are respectively.

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(A) ✓ 0.0035 and $\dfrac{f_y}{1.15E_s} + 0.002$

(B) 0.0035 and $\dfrac{f_y}{1.15E_s} + 0.0035$

(C) 0.002 and $\dfrac{f_y}{1.15E_s} + 0.002$

(D) 0.0035 and $\dfrac{E_s}{1.15f_y} + 0.002$

11. The four columns of same material and same dimensions are supported in the following ways.
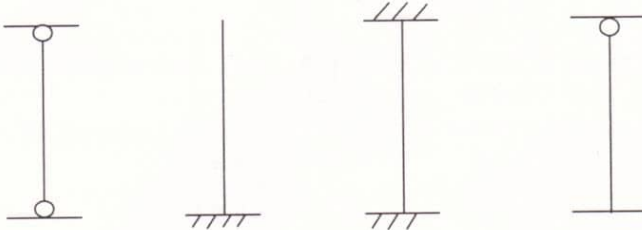
The columns are to be arranged in the increasing order of their buckling load. The correct order will be

(A)   I, II, III, IV

(B)   II, I, III, IV

(C)   I, II, IV, III

(D) ✓   II, I, IV, III

12. The permissible load for a column with helical reinforcement shall be .... time the permissible load for similar member with lateral tie provided the ratio of the volume of helical reinforcement to the volume of the core should not be less than ....

(A) $1.1, 0.36\left[\dfrac{Ag}{Ac} - 1\right]\dfrac{f_{ck}}{f_y}$

(B) $1.1, 0.36\left[\dfrac{Ag}{Ac} - 1\right]\dfrac{f_y}{f_{ck}}$

(C) ✓ $1.05, 0.36\left[\dfrac{Ag}{Ac} - 1\right]\dfrac{f_{ck}}{f_y}$

(D) $1.05, 0.36\left[\dfrac{Ag}{Ac} - 1\right]\dfrac{f_y}{f_{ck}}$

The symbols have their usual meaning.

13. What will be the load carrying capacity of an axially loaded short column having 90000 mm² as concrete area and 600 mm² as steel area? f_{ck} is 25N/mm² and f_y is 500 N/mm²

(A)   1000 kN

(B)   1300 kN

(C)   1200 kN

(D) ✓   1100 kN

14. Study the following statements
   (i)   Factor of safety of concrete should be based on its yield stress.
   (ii)   Factor of safety of steel should be based on its yield stress.
   (iii)   Factor of safety of concrete should be based on its ultimate stress.
   (iv)   Factor of safety of steel should be based on its ultimate stress.
The correct statements are
   (A)   (i) and (ii)
   (B) ✓ (ii) and (iii)
   (C)   (iii) and (iv)
   (D)   (iv) and (i)

15. The column of diameter 500 mm is reinforced with 6 bars of 20 mmØ. What should be the pitch of 6 mmØ lateral tie?

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   (A) ≤ 320 mm ✓
   (B) ≤ 500 mm
   (C) ≤ 250 mm
   (D) 200 mm

16. $ML^{-1}T^{-2}$ is the dimensional formula of

   (A) Pressure
   (B) Stress
   (C) Modulus of elasticity
   (D) All of these ✓

17. For a catchment with an area of 360 km^2 ,the equilibrium discharge of a S- curve obtained by 4 hour unit hydrograph summation is _____ m^3/s

   (A) 250 ✓
   (B) 1.5×10^4
   (C) 90×10^4
   (D) 1.5×10^3

18. The total stress and effective stress at a depth of 10 m below the water surface in a lake are respectively

   (A) Zero and zero
   (B) Zero and 98.1 kN/m^2
   (C) 98.1 kN/m^2 and zero ✓
   (D) 98.1 kN/m^2 and 98.1 kN/m^2

19. For better strength and stability, the fine grained soils and coarse grained soils are respectively compacted as

   (A) Wet of OMC and dry of OMC ✓
   (B) Dry of OMC and wet of OMC
   (C) Wet of OMC and wet of OMC
   (D) Dry of OMC and dry of OMC

20. During the consolidation process of a saturated clay, there is

   (A) A gradual increase in neutral pressure and a gradual decrease in effective pressure occurs and the sum of the two remains constant
   (B) A gradual decrease in neutral pressure and a gradual decrease in effective pressure occurs and the sum of the two remains constant ✓
   (C) Both neutral pressure and effective pressure decreases
   (D) Both neutral pressure and effective pressure increases

21. The soil sample has been found to have natural moisture content of 40%, liquid limit of 60% and plastic limit of 30%. Soil is said to possess

   (A) Medium consistency
   (B) Very soft consistency
   (C) Soft consistency
   (D) Stiff consistency ✓

22. A discharge of 100 m³/s flows through a rectangular channel at a depth of 5 m. The width of channel as per Lacey's formula should be

    (A)   37.5 m   (B)   47.5 m

    (C)   20 m   (D)   25 m

23. 20000 m³ of water is supplied per day to a city after treating it with Cl_2 dose of 0.6 ppm. For this purpose, the requirement of 30% bleaching powder per day would be

    (A)   4 kg   (B)   12 kg

    (C)   40 kg   (D)   120 kg

24. If the x component of the velocity is $u = 6xy - 2x^2$ then the y component of flow v is given by

    (A) $4xy - 3y^2$ (B) $6y^2 - 4xy$

    (C) $-6xy + 2x^2$ (D) $5x^2 - 2xy$

25. The base period of a particular crop is 50 days and the duty of the canal is 500 hactares per cumec. The depth of water will be.

    (A)   0.864 cm   (B)   8.64 cm

    (C)   86.4 cm   (D)   864 cm

26. A concrete sewer of 2 m diameter is laid at a slope of 1 in 1000. When the sewer runs half full, the velocity of flow is 1 m/s. What will be the velocity when the sewer runs full?

    (A)   1m/s   (B)   2m/s

    (C)   2.5m/s   (D)   0.5m/s

27. The moment of inertia of a rectangular plate of width b and depth d about the face having width b is

    (A) $\frac{1}{12} bd^3$ (B) $\frac{1}{6} bd^3$

    (C) $\frac{1}{3} bd^3$ (D) $\frac{1}{8} bd^3$

28. Two concentrated loads of 12 kN and 6 kN are respectively placed at 1 m and 2 m from the support of a cantilever beam of 2 m length. The self weight of beam is 1 kN/m. The maximum shear force will be

    (A)   16 kN   (B)   24 kN

    (C)   20 kN   (D)   10 kN

29. A pump lifts 50 m³ of water to a height of 10 m. The energy spent to lift the water is

    (A) 5×10^6 kg – m   (B) 5×10^5 kg – m

    (C) 5×10^4 kg – m   (D) 5×10^3 kg – m

30. A rectangular beam of 30 cm depth and 20 cm breadth is having maximum bending moment 60 kNm at the centre. The moment of inertia of the beam is 45000 cm⁴. The maximum bending stress will be

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(A)   1 kN/cm² at the boundary

(B)   2 kN/cm² at the boundary

(C) $2/3$ kN/cm² at the boundary

(D) $4/3$ kN/cm² at the boundary

31. The following data pertain to a sewage sample:
Initial D.O. = 10 mg/l
Final D.O. = 2 mg/l
Dilution to 1%
The BOD of the given sewage sample is

(A)   8 mg/l

(B)   10 mg/l

(C)   100 mg/l

(D)   800 mg/l

32. The area between two isohytes of 35 cm and 45 cm is 100 sq. km and between 45 cm and 55 cm is 300 sq. km, the average depth of precipitation over the above basin of 400 sq. km will be

(A)   45 cm

(B)   48 cm

(C)   50 cm

(D)   40 cm

33. If the principal stresses in a stressed body are 100 N/mm² and -50 N/mm² , the maximum shear stress will be

(A)   − 50 N/mm²

(B)   25 N/mm²

(C)   75 N/mm²

(D)   − 25 N/mm²

34. The permeability of soil at 10° C is 2 cm/sec. If the temperature is increased to 25° C, the permeability of soil sample will be

(A)   Less than 2 cm/s

(B)   More than 2 cm/s

(C)   2 cm/s

(D)   1.9 cm/s

35. The pressure head at a certain point in a pipe is 3.5 m of water. The pressure at that point will be

(A)   3.5 kg/cm²

(B)   3.5 kg/m²

(C)   0.35 kg/cm²

(D)   35 kg/m²

36. Select the correct statement

(A)   Psychological extra widening depends on the number of traffic lanes

(B)   Mechanical extra widening depends on the speed of vehicle

(C)   Psychological extra widening depends on the length of wheel base

(D)   Mechanical extra widening depends upon the length of wheel base and radius of curve

37. If the time required for 60% consolidation of a remoulded soil sample of clay with single drainage is 't', then what is the time required to consolidate the same sample of clay with the same degree of consolidation but with double drainage?

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(A). 4t   (B) 2t

(C) t/2   (D) t/4 ✓

38. Pneumatic tyred rollers are suitable for compacting

(A) ✓ Non plastic silt and fine sands   (B) Clayey soil

(C) Cohesiveness granular material   (D) Black cotton soil

39. The critical section for the bending moment in isolated square footing shall be

(A) At half the effective depth of footing from the periphery of the column

(B) At effective depth of footing from the periphery of the column

(C) ✓ At the periphery of the column

(D) At the centre of the footing

40. Study the following statements

(i) Flexural limiting strength of a given concrete beam is a function of grade of concrete and grade of steel
(ii) The permissible shear strength of concrete is function of proportion of tensile steel in beam and the grade of concrete
(iii) The maximum permissible shear stress of concrete is a function of grade of concrete

The correct statements are:

(A) Both (i) and (iii)   (B) Both (ii) and (iii)

(C) Both (i) and (ii)   (D) ✓ (i), (ii) and (iii)