BMT-2/BMV-2 PROVISIONAL ANSWER KEY

| Name of the post | Gujarat Engineering Service (Civil), Class-1 and Class-2 |
|----------------------------------|--|
| Advertisement No. | 51-126/2024-25 |
| Preliminary Test Held On | 26-04-2025 |
| Que. No | 001-300 |
| Publish Date | 06-05-2025 |
| Last Date to Send Suggestion (s) | 09-05-2025 |
| THE LINK FOR ONLINE OBJECTION | N SYSTEM WILL START FROM 07-05-2025 ; 10:00 AM ONWARDS |

Instructions / સૂચના

Candidate must ensure compliance to the instructions mentioned below, else objections shall not be considered: -

- (1) Candidates have to pay fees of Rs.100/- for each objection. The fees can be paid from the link given herewith.
- (2) The Candidate will be able to submit objection only after payment of the fees. The generation of the receipt will only be considered as final submission.
- (3) The Candidate must retain the receipt of the payment of the fees. The fees, once paid, will not be refunded under any circumstances.
- (4) All the objections should be submitted through **ONLINE OBJECTION SUBMISSION SYSTEM** only. Physical or submission through any other means will not be considered.
- (5) All objections are to be submitted with reference to the Master Question Paper published with provisional answer key, published herewith on the website / online objection submission system. Objections should be sent referring to the Question No. & options of the Master Question Paper. <u>Objections regarding question nos. and options other than provisional answer key (Master Question Paper) shall not be considered.</u>
- (6) Objections and answers suggested by the candidate should be in compliance with the responses given by him in his answer sheet. Objections shall not be considered, in case, if responses given in the answer sheet /response sheet and submitted objections are differed.
- (7) Supportive document to the objection must be uploaded, without which objection will not be considered.

ઉમેદવારે નીચેની સૂચનાઓનું પાલન કરવાની તકેદારી રાખવી, અન્યથા વાંધા-સૂચન અંગે કરેલ રજૂઆતો ધ્યાને લેવાશે નહીં

- (1) ઉમેદવારે દરેક વાંધા દીઠ રૂપિયા ૧૦૦/-ફી ભરવાની રહેશે. જે ફી આ સાથે આપેલ લીંક ઉપરથી ભરી શકાશે.
- (2) ફી ભર્યા બાદ જ વાંધો સબમીટ થઈ શક્શે. ફી ભર્યાની આખરી પહોંચ જ આખરી સબમીશન ગણાશે.
- (3) ફી ભર્યાની પહોંચ ઉમેદવારે સાચવી રાખવાની રહેશે. એક વાર ભરેલ ફી કોઈ પણ પરિસ્થિતિમાં પરત આપવામાં આવશે નહિ.
- (4) વાંધા ફક્ત ઓનલાઈન ઓબ્જેકશન સબમીશન સીસ્ટમ દ્રારા જ સબમીટ કરવાના રહેશે. રૂબરૂ, ટપાલ અથવા ઈ-મેઈલ કે અન્ય કોઈ રીતે આયોગને મોકલવામાં આવેલ વાંધા ધ્યાને લેવામાં આવશે નહીં, જેની ખાસ નોંધ લેવી.
- (5) ઉમેદવારે પોતાને પરીક્ષામાં મળેલ પ્રશ્નપુસ્તિકામાં છપાયેલ પ્રશ્નક્રમાંક મુજબ વાંધા-સૂચનો રજૂ ન કરતાં, તમામ વાંધા-સૂચનો વેબસાઈટ પર પ્રસિધ્ધ થયેલ પ્રોવિઝનલ આન્સર કી (માસ્ટર પ્રશ્નપત્ર) ના પ્રશ્નક્રમાંક મુજબ અને તે સંદર્ભમાં રજૂ કરવા. <u>માસ્ટર પ્રશ્નપત્રમાં નિર્દિષ્ટ પ્રશ્ન અને</u> <u>વિકલ્પ સિવાયના વાંધા ધ્યાને લેવામાં આવશે નહીં.</u>
- (6) ઉમેદવારે પ્રશ્નના વિકલ્પ પર વાંધો રજૂ કરેલ છે અને વિકલ્પ રૂપે જે જવાબ સૂચવેલ છે એ જવાબ ઉમેદવારે પોતાની ઉત્તરવઠીમાં આપેલ ઠોવો જોઈએ. ઉમેદવારે સૂચવેલ જવાબ અને ઉત્તરવઠીનો જવાબ ભિન્ન ઠશે તો ઉમેદવારે રજૂ કરેલ વાંધા ધ્યાને લેવાશે નઠીં.
- (7) वांधा माटे संદर्ભ જોડવો આવશ્યક છે, જેના વિના વાંધો ધ્યાને લેવામાં આવશે નહીં.

- 1. Stress at any point in a material is defined as
 - (A) load per unit area
 - (B) resisting force per unit area
 - (C) modulus elasticity times strain
 - (D) none of the above
- 2. If the one-way eccentricity along Y-axis is 0.1 m for a 2 m × 2 m square footing, then the effective area of the footing is

| (A) $4 m^2$ | (B) 3.6 m^2 | |
|-----------------------|-----------------------|--|
| (C) 3.8 m^2 | (D) None of these | |

3. Bar 'A' has diameter *d* and length *L*. Bar 'B' has diameter 2*d* and length 2*L*. The ratio of extension of bar A to extension of bar B is

4. A bar of uniform cross-section *A* and length *L* is suspended from top. The extension of the bar due to self-weight only in terms of Young's modulus *E* and unit weight γ is

(A)
$$\frac{\gamma L^2}{2E}$$

(B) $\frac{\gamma L^2}{AE}$
(C) $\frac{\gamma L}{2E}$
(D) $\frac{\gamma L}{2E}$

5. The relationship among modulus of elasticity *E*, modulus of rigidity *G* and bulk modulus *K* is

(A)
$$\frac{3}{E} = \frac{9}{G} - \frac{1}{K}$$

(B) $\frac{3}{E} = \frac{9}{G} + \frac{1}{K}$
(C) $\frac{9}{E} = \frac{3}{G} - \frac{1}{K}$
(D) $\frac{9}{E} = \frac{3}{G} + \frac{1}{K}$

6. Liming value of Poisson's ratio are

7. Section modulus of the rectangular section with breadth *b* and depth *d* is

(A)
$$\frac{1}{12} bd^3$$
 (B) $\frac{1}{3} bd^3$
(C) $\frac{1}{6} bd^2$ (D) $\frac{1}{3} bd^2$

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- 8. What is the ratio of maximum shear stress to the average shear stress for a beam of rectangular cross-section?
 - (A) 1.25 (B) 1.5 (C) 2.0 (D) 4.0
- 9. In the case of a cantilever of span L subjected to concentrated load W at the free end, the rotation (q) and deflection (y) of the free end are

(A)
$$q = \frac{WL}{EI}$$
, $y = \frac{WL^2}{2EI}$
(B) $q = \frac{WL^2}{2EI}$, $y = \frac{WL^2}{3EI}$
(C) $q = \frac{WL^3}{EI}$, $y = \frac{WL^4}{8EI}$
(D) $q = \frac{WL^3}{24EI}$, $y = \frac{WL^3}{24EI}$

10. A cantilever of span L is subjected to a uniformly distributed load of intensity w from free end up to mid-span. Its deflection at the free end is

(A)
$$\frac{5wL^4}{384EI}$$
 (B) $\frac{41wL^4}{384EI}$
(C) $\frac{21wL^4}{384EI}$ (D) $\frac{5wL^4}{192EI}$

11. With usual notations, the torsional equation for shafts of circular cross-sections is

(A)
$$\frac{T}{J} = \frac{\tau}{\theta} = \frac{Gr}{L}$$

(B) $\frac{T}{r} = \frac{\tau}{J} = \frac{Gr}{L}$
(C) $\frac{T}{J} = \frac{\tau}{L} = \frac{G\theta}{r}$
(D) $\frac{T}{J} = \frac{\tau}{r} = \frac{G\theta}{L}$

12. The angle between the direction of the maximum principal plane and the maximum shear plane is

| (A) 30° | (B) 45° |
|---------|-----------------------|
| (C) 60° | (D) none of the above |

13. In a thin cylinder of diameter *d*, thickness *t* subjected to internal pressure, the circumferential stress developed is

(A)
$$\frac{pd}{t}$$
 (B) $\frac{pd}{2t}$
(C) $\frac{pd}{4t}$ (D) $\frac{pd}{8t}$

14. The critical load for a long column is 160 kN. If the same section is to be used for another column of double length, then the critical load is

| (A) 320 kN | (B) 160 kN | |
|------------|------------|--|
| (C) 80 kN | (D) 40 kN | |

- Μ
- 15. A beam with end A having fixed support, end B having roller support and an internal hinge at C. Its conjugate beam is
 - (A) end A is free, ends B and C are on roller
 - (B) end A is hinged, end B is fixed, C is on roller
 - (C) end A is free, end B is fixed and C is hinged
 - (D) end A is fixed, B is hinged and C is hinged
- 16. The absolute bending moment in a simply supported beam of span 10 m due to a moving load of 40 kN/m spanning over 5 m is
 - (A) 375 kN m at 2.5 m from end A
 - (B) 375 kN m at midpoint
 - (C) 375 kN m at 3.75 m from end A
 - (D) 500 kN m at midspan
- 17. A parabolic arch of span L has central rise h. Taking the springing point as the origin, its equation is given by

(A)
$$\frac{hx(L-x)}{L}$$
 (B) $\frac{hx(L-x)}{L^2}$
(C) $\frac{4hx(L-x)}{L^2}$ (D) $\frac{8hx(L-x)}{L^2}$

18. Uniformly distributed load w per unit length is suspended from a cable between points A and B. If points A and B are at the same level at distance *l* and the central sag of the cable is *h*, then the horizontal thrust developed of supports is

8*h*

(A)
$$\frac{wl}{2h}$$
 (B) $\frac{wl^2}{4h}$
(C) $\frac{wl}{4h}$ (D) $\frac{wl^2}{2h}$

19. The degree of indeterminacy of the beam shown in the figure is



4h

20. A propped cantilever of span L is fixed at end A and simply supported at end B. It is subjected to a uniformly distributed load of intensity w per unit length, the reactions at A and B are

(A)
$$R_A = \frac{5wl}{8}, R_B = \frac{3wl}{8}$$

(B) $R_A = R_B = \frac{wl}{2}$
(C) $R_A = \frac{3wl}{8}, R_B = \frac{5wl}{8}$
(D) $R_A = \frac{wl}{8}, R_B = \frac{3wl}{8}$

21. If M_{FAB} and M_{FBA} are the fixed moments in a fixed beam of span L, then the rotation at end A is

(A)
$$\frac{L}{3EI} (M_{FAB} + 2M_{FBA})$$

(B) $\frac{L}{3EI} (2M_{FAB} + M_{FBA})$
(C) $\frac{L}{6EI} (M_{FAB} + 2M_{FBA})$
(D) $\frac{L}{6EI} (2M_{FAB} + M_{FBA})$

22. The given figure shows a frame to be analysed by moment distribution. The distribution factors for members EB, ED and EF will be ______ respectively



| $(A) \frac{2}{9}, \frac{4}{9}, \frac{1}{3}$ | (B) $\frac{8}{13}, \frac{3}{13}, \frac{4}{13}$ |
|--|---|
| $(C) \frac{3}{10}, \frac{4}{10}, \frac{3}{10}$ | (D) $\frac{4}{11}, \frac{4}{11}, \frac{3}{11}$ |

- 23. In a two-hinged parabolic arch,
 - (i) if support yields, then horizontal thrust increases
 - (ii) if ribshortening is considered, then horizontal thrust reduces
 - Which is the CORRECT option?
 - (A) Both (i) and (ii) are true
 - (B) (i) is true but (ii) is false
 - (C) (i) is false but (ii) is true
 - (D) Both (i) and (ii) are false

24. (i) The number of equilibrium equations needed to find the displacement components of all joints of the structure is known as the degree of redundancy.

(D) Both (i) and (ii) are false

(ii) The kinematic indeterminacy is also known as the degree of redundancy.

Which is the correct option?

- (A) Both (i) and (ii) are true (B) (i) is true, but (ii) is false
- (C) (i) is false, but (ii) is true
- 25. Flexibility matrix method is known as
 - (i) Force method

- (ii) Compatibility method
- (iii) Displacement method
- (iv) Equilibrium method
- Which is the correct option?
- (A) (i) and (ii) are true (B) (ii) and (iii) are true
- (C) (iii) and (iv) are true (D) (i) and (iv) are true
- 26. The degree of kinematic indeterminacy of the trust shown in the figure is



- 27. The element d_{ii} if, a flexibility matrix is
 - (A) the displacement at coordinate j due to a unit force at coordinate i
 (B) the displacement at coordinate i due to a unit force at coordinate j
 (C) the force at coordinate j due to a unit displacement at coordinate i
 (D) the force at coordinate i due to a unit displacement at coordinate j
- 28. The shape factor of a circular section with radius R is

(A)
$$\frac{4R}{3\pi}$$
 (B) $\frac{4R}{\pi}$

(C)
$$\frac{16}{3\pi}$$
 (D) $\frac{8}{3\pi}$

29. The shape factor of I section is

| (A) 1.2 | (B) 1.5 |
|----------------|-----------------------|
| (C) 2.0 | (D) none of the above |

30. Collapse load in a fixed beam of span L, carrying uniformly distributed load over the entire span and having plastic moment capacity M_{p} is

| (A) $\frac{6M_p}{L}$ | (B) $\frac{8M_p}{L}$ |
|------------------------|-------------------------|
| $(C) \frac{8M_p}{L^2}$ | (D) $\frac{16M_p}{L^2}$ |

31. The minimum grade of concrete for moderate exposure with normal weight aggregates is

| (A) M 15 | (B) M 20 |
|----------|----------|
| (C) M 25 | (D) M 35 |

32. In the absence of data, the approximate value of the total shrinkage strain may be taken as

| (A) 0.0001 | (B) 0.0003 | |
|------------|-------------------|--|
| (C) 0.001 | (D) 0.003 | |

33. If the age of loading on the concrete structure is 28 days, then the creep coefficient may be taken as

| (A) 2.2 | (B) 2.0 |
|----------------|----------------|
| (C) 1.8 | (D) 1.6 |

34. In the working stress method of R.C.C. design, the modular ratio between steel and concrete used is

| 230 | _ | 230 |
|--------------------|-----|---------------|
| (A) $3\sigma_{bc}$ | (B) | σ_{bc} |
| 280 | _ | 280 |
| (C) $3\sigma_{bc}$ | (D) | σ_{bc} |

35. Characteristic load is

(A) mean load

(B) mean load + 1.64 times the standard deviation

- (C) mean load 1.64 times the standard deviation
- (D) none of the above

36. If the standard deviation is 4 N/mm², then the mean strength of M20 concrete should be

(A) 16 N/mm² (C) 24 N/mm² (D) 26.4 N/mm²

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37. Partial safety factors for dead load and imposed load combination for limit state of serviceability are

| (A) 1.0 and 1.0 | (B) 1.5 and 1.5 | |
|-----------------|------------------------|--|
| (C) 1.2 and 1.2 | (D) 1.0 and 0.8 | |

38. IS code considering concrete has reached its limit state of collapse when the strain is

39. For a rectangular beam of size $b \times d$, with yield stress of steel f_y , area of steel A_{st} , concrete with characteristic strength f_{ck} , for under-reinforced section, neutral axis to depth ratio is given by

(A)
$$\frac{x_u}{d} = \frac{0.87 \times f_y \times A_{st}}{0.36 \times f_{ck} \times bd}$$
(B)
$$\frac{x_u}{d} = \frac{0.87 \times f_y \times bd}{0.36 \times f_{ck} \times A_{st}}$$
(C)
$$\frac{x_u}{d} = \frac{f_y \times A_{st}}{f_{ck} \times bd}$$
(D) None of the above

40. The seating stress applied while saturating a consolidation test specimen is
(A) 1 kg/cm²
(B) 0.5 kg/cm²

(C) 0.05 kg/cm² (D) None of these

41. The vertical component of shear resisted by vertical stirrup in the reinforced concrete beam is given by (where f_v , A_{sv} , d and S_v have usual meaning)

(A)
$$\frac{0.87 \times f_y \times A_{sv}}{S_v} \times d$$
(B)
$$\frac{f_y \times A_{sv}}{S_v} \times d$$
(C)
$$\frac{0.87 \times f_y \times A_{sv}}{S_v} \times d^2$$
(D)
$$\frac{f_y \times A_{sv}}{S_v} \times d^2$$

42. According to IS 456:2000, an equivalent moment in a rectangular RCC beam under torsion can be calculated as

(A)
$$M_e = M_u + \frac{1 + \frac{D}{b}}{1.7}$$
 (B) $M_e = M_u + T_u$
(C) $M_e = M_u + \frac{\frac{D}{b}}{1.7}$ (D) $M_e = M_u + \frac{\frac{D}{b}}{7}$

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[Contd.

43. The maximum eccentricity to be considered in a reinforced concrete column of length *l* is

| (A) - | <i>l</i> 400 | + Lateral dimension 30 | (B) $\frac{l}{500} + \frac{l}{500}$ | Lateral dimension 30 |
|-------|-----------------|----------------------------------|-------------------------------------|-------------------------|
| (C) - | <i>l</i> 500 | + <u>Lateral dimension</u> 25 | (D) $\frac{l}{400}$ + | Lateral dimension 25 |

44. For laterally loaded short pile, the failure is expected to occur due to

| (A) Shear failure of soil | (B) Shear failure of pile |
|---------------------------|---------------------------|
| | |

- (C) Yielding of pile (D) None of these
- 45. In a column, the minimum diameter of the bar to be used is

| (A) 10 mm | (B) 12 mm |
|-----------|-----------|
| (C) 16 mm | (D) 20 mm |

46. According to the limit state method, the ratio of the parabolic stress block to the rectangular stress block in a balanced RCC beam is

| (A) 3/7 | (B) 4/7 |
|-----------------|----------------|
| (C) 3 /4 | (D) 4/3 |

- 47. In the design of isolated column footing of thickness *d*, the critical section from the consideration of single shear is
 - (A) at column face
 - (B) at a distance *d*/4 from the column face
 - (C) at a distance d/2 from the face of the column
 - (D) at a distance d from the face of the column
- 48. The lightest I-section for the same depth is

| (A) ISMB | (B) ISLB |
|----------|----------|
| (C) ISJB | (D) ISWB |

49. If p is the pitch, d is the nominal diameter and d' is the bolt hole diameter, then the minimum pitch is

| $(\mathbf{A}) 3 d$ | (B) 3 <i>d</i> ' |
|--------------------|--------------------|
| (C) $2.5 d$ | (D) 2.5 <i>d</i> ' |

- 50. If *t* is the thickness of a thinner plate in a bolted connection of tension member, then the pitch shall not be more than
 - (A) 16t or 200 mm, whichever is less
 - (B) 16t or 200 mm, whichever is more
 - (C) 12t or 150 mm, whichever is less
 - (D) 12t or 150 mm, whichever is more
- 51. In a bracket, if load *p* acts at an eccentricity *e* producing moment in the plane of the group of bolts, the stress induced in a bolt at distance *r* from the centroid of the group due to moment alone is

(A)
$$\frac{per}{\Sigma_r}$$

(B) $\frac{per}{\Sigma_r^2}$
(C) $\frac{pe}{\Sigma_r}$
(D) None of the above

- 52. If V_{sb} is the factored shear force, T_b is the factored tensile force, V_{db} is the design shear force and T_{db} is the design tensile force, then the design requirement of bolted connection subjected to direct shear and axial tension is
 - (A) $(\frac{V_{sb}}{V_{db}})^2 + (\frac{T_b}{T_{db}})^2 \le 1.0$ (B) $(\frac{V_{db}}{V_{sb}})^2 + (\frac{T_{db}}{T_b})^2 \le 1.0$ (C) $\frac{V_{sb}}{V_{db}} + \frac{T_b}{T_{db}} \le 1.0$ (D) $\frac{V_{db}}{V_{sb}} + \frac{T_{db}}{T_b} \le 1.0$
- 53. HSFG bolts transfer load is mainly due to

| (A) friction | (B) shearing |
|--------------|-----------------------|
| (C) bearing | (D) none of the above |

- 54. If a weld is subjected to axial stress f_a and shear stress q, then equivalent stress f_c to be considered is
 - (A) $\sqrt{(f_a^2 + q^2)}$ (B) $\sqrt{(f_a^2 + 2q^2)}$ (C) $\sqrt{(2f_a^2 + q^2)}$ (D) $\sqrt{(f_a^2 + 3q^2)}$
- 55. According to IS 800–2007, how many buckling classes are classified?
 - (A) 3 (B) 4
 - (C) 5 (D) 6

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56. For double lacing, how many times the thickness of the lacing bar should not be less than its effective length?

(A)
$$\frac{1}{16}$$
 (B) $\frac{1}{20}$
(C) $\frac{1}{24}$ (D) $\frac{1}{30}$

57. What is the ratio between the effective slenderness ratio of battened columns and the maximum slenderness ratio of the columns?

| (A) 1.05 | (B) 1.10 |
|-----------------|-----------------|
| (C) 1.15 | (D) 1.20 |

58. Slenderness ratio *l* of a vertical stiffener in a plate girder may be taken as

(A)
$$0.5 \frac{L}{r}$$
 (B) $0.7 \frac{L}{r}$
(C) $0.75 \frac{L}{r}$ (D) $\frac{L}{r}$

- 59. For finding the buckling resistance of a stiffener in a plate girder, the area of the web to be added is
 - (A) 20 t_w from one side (B) 20 t_w from each side
 - (C) 28 t_w from one side (D) 28 t_w from each side
- 60. Gantry girders are designed to resist
 - (A) vertical load from cranes
 - (B) longitudinal and vertical loads
 - (C) lateral, longitudinal and vertical loads
 - (D) lateral and longitudinal loads
- 61. Which property of aggregates is tested using the Los Angeles abrasion test?
 - (A) Strength (B) Hardness
 - (C) Durability (D) Water absorption
- 62. What is the purpose of adding gypsum to cement during its production?
 - (A) To increase strength (B) To control setting time
 - (C) To improve colour (D) To reduce heat

63. What is the standard size of a brick in India as per IS codes?

- (A) 190 mm × 90 mm × 90 mm (B) 200 mm × 100 mm × 100 mm
- (C) 210 mm × 100 mm × 100 mm (D) 190 mm × 100 mm × 100 mm

- 64. Which test is used to measure the toughness of aggregates?
 - (A) Impact test (B) Crushing test
 - (C) Abrasion test (D) Soundness test
- 65. Which test is conducted to check the resistance of aggregates to weathering?
 - (A) Crushing test (B) Soundness test
 - (C) Impact test (D) Flakiness index test
- 66. What is the role of bacteria in bio-concrete?
 - (A) To reduce setting time

- (B) To improve compressive strength
- (C) To produce calcium carbonate for self-healing cracks
- (D) To increase workability
- 67. 3D printing technology in concrete construction primarily involves
 - (A) Use of lightweight aggregates
 - (B) Layer-by-layer deposition of concrete
 - (C) Mixing concrete with nanoparticles
 - (D) Using recycled aggregates exclusively
- 68. Why does the stress-strain curve of concrete exhibit a non-linear response even at low stress levels?
 - (A) Due to microcracking in the cement paste
 - (B) Due to plastic deformation of aggregates
 - (C) Due to perfect elasticity of concrete
 - (D) Due to strain hardening behavior
- 69. The primary purpose of adding iron oxide to clay during brick manufacturing is to
 - (A) Improve strength
 - (B) Enhance durability
 - (C) Provide red colour to the bricks
 - **(D)** Reduce efflorescence
- 70. Which type of lime is used in mortar for plastering works?
 - (A) Quick lime (B) Hydraulic lime
 - (C) Fat lime (D) Dolomitic lime

- 71. In the context of aggregates, the term "flakiness index" refers to
 - (A) The angularity of the particles
 - (B) The percentage of flat and elongated particles
 - (C) The hardness of the aggregate
 - (D) The porosity of the aggregate

72. Pozzolanic materials react with which component of cement paste to form additional cementitious compounds?

- (A) Calcium silicates (B) Calcium hydroxide
- (C) Tricalcium aluminate (D) Tetracalcium aluminoferrite
- 73. What is the typical pH value of fresh concrete?

| (A) $7 - 8$ | (B) 9 – 10 |
|-------------|-------------|
| (C) 11 – 13 | (D) 14 – 15 |

- 74. Knots in wood reduce its strength by
 - (A) Decreasing its density
 - (B) Interrupting the continuity of fibers
 - (C) Altering its moisture content
 - (D) Increasing its elasticity
- 75. Which chemical compound in cement is responsible for its early strength?
 - (A) Tricalcium silicate (C₃S)
 - (B) Dicalcium silicate (C₂S)
 - (C) Tricalcium aluminate (C₃A)
 - (D) Tetracalcium aluminoferrite (C₄AF)
- 76. What is the typical range of strain corresponding to the peak stress (ultimate strength) in ordinary concrete?

| (A) 0.001 – 0.002 | (B) 0.002 – 0.0035 |
|---------------------------------|---------------------------|
| (C) 0.0035 – 0.005 | (D) 0.005 – 0.007 |

- 77. The strength of plywood in the direction of the grain is compared to the strength across the grain in which way?
 - (A) Stronger along the grain
 - (B) Stronger across the grain
 - (C) Equal in both directions
 - (D) Plywood has no directional strength

- 78. The modulus of elasticity of concrete is derived from the stress-strain curve by considering
 - (A) Secant modulus at 0.2% strain
 - (B) Initial tangent modulus at the origin
 - (C) Tangent modulus at the peak stress
 - (D) Secant modulus at a specific stress level
- 79. The efflorescence test for bricks determines the presence of which compounds?
 - (A) Lime and silica
 - (B) Sulfates and alkalis
 - (C) Alumina and magnesium
 - (D) Iron oxide and calcium
- 80. In the context of tensile strength, which of the following statements about concrete is correct?
 - (A) Concrete has high tensile strength but low compressive strength
 - (B) Concrete exhibits low tensile strength compared to its compressive strength
 - (C) Concrete has equal tensile and compressive strength
 - (D) Concrete does not have tensile strength
- 81. Which of the following is the main advantage of using laminated veneer lumber (LVL) over traditional timber?
 - (A) Higher bending strength and stiffness
 - (B) Greater resistance to moisture
 - (C) Cheaper than solid timber
 - (D) Better aesthetic appeal
- 82. Retarding admixtures are commonly used in which of the following situations?
 - (A) Cold weather concreting
 - (B) To improve early strength gain
 - (C) To enhance workability
 - **(D)** Hot weather concreting
- 83. Which of the following types of cement is most commonly used for mass concrete work such as large foundations or dams?
 - (A) Ordinary Portland Cement (OPC)
 - (B) Rapid Hardening Cement (RHC)
 - (C) Sulphate Resisting Cement (SRC)
 - (D) Low Heat Cement (LHC)

- 84. The process of "seasoning" of timber is done to
 - (A) Increase its strength
 - (B) Remove moisture content
 - (C) Improve its resistance to fire
 - (D) Make it more resistant to pests
- 85. The primary cause of reinforcement corrosion in concrete is
 - (A) High water-cement ratio
 - **(B)** Exposure to carbon dioxide
 - (C) Low water-cement ratio
 - (D) High curing temperature
- 86. Which of the following is responsible for the setting time retardation in cement when exposed to excessive water content or high temperatures?
 - (A) Calcium silicate hydrate (C-S-H)
 - (B) Calcium hydroxide (Ca(OH)₂)
 - (C) Ettringite formation
 - **(D)** Tricalcium aluminate (C₃A)
- 87. The use of calcium chloride as an accelerating admixture is generally avoided in
 - (A) Cold weather conditions
 - (B) Concrete with embedded steel reinforcement
 - (C) Concrete pavements
 - (D) Mass concrete works
- 88. Which of the following defects in wood is caused by the unequal shrinkage of its fibers?

| (A) Knots | (B) Twisting |
|------------|------------------|
| (C) Checks | (D) Honeycombing |

- 89. What is the term for the amount submitted by a contractor to secure their commitment to a tender?
 - (A) Performance Bond
 - **(B)** Tender Fee
 - (C) Earnest Money Deposit (EMD)
 - (D) Retention Money

90. What is the term for the practice of bidding very low to secure a tender, with plans to adjust costs later?

| (A) Value engineering | (B) Front-loading |
|-----------------------|------------------------|
| (C) Predatory pricing | (D) Unbalanced bidding |

91. Which tendering method is often used for complex or specialized projects?

| (A) Open tendering | (B) Single tendering |
|--------------------------|-------------------------|
| (C) Negotiated tendering | (D) Two-stage tendering |

92. Match the types of wood in List I with their specific characteristics in List II.

| List I | List II | |
|------------------------|--|--|
| (Types of Wood) | (Applications) | |
| 1. Plywood | A. Thin decorative layers applied on surfaces | |
| 2. Veneer | B. Manufactured board used for lightweight furniture | |
| 3. Timber | C. Structural purposes like beams and columns | |
| 4. Particle Board | D. Made by gluing thin sheets of wood together | |
| (A) 1-D, 2-A, 3-C, 4-B | (B) 1-A, 2-C, 3-D, 4-B | |
| (C) 1-B, 2-D, 3-A, 4-C | (D) 1-C, 2-B, 3-D, 4-A | |

93. Match the components/processes in List I with their descriptions or roles in cement manufacturing in List II.

| List I | List II | |
|------------------------|--|--|
| (Components/Processes) | (Descriptions/Roles) | |
| 1. Limestone | A. Added to control the setting time of cement | |
| 2. Clinker | B. Raw material providing calcium carbonate | |
| 3. Gypsum | C. Intermediate product formed after calcination | |
| 4. Rotary Kiln | D. Equipment used for heating materials at high temperatures | |
| (A) 1-C, 2-B, 3-D, 4-A | (B) 1-B, 2-C, 3-A, 4-D | |
| (C) 1-A, 2-D, 3-C, 4-B | (D) 1-D, 2-A, 3-B, 4-C | |

94. For a concrete mix with a characteristic strength of M40, if the standard deviation of compressive strength is 5 MPa, then what should be the target mean strength of the mix?

| (A) 40 MPa | (B) 45 MPa |
|---------------|------------|
| (C) 48.25 MPa | (D) 52 MPa |

95. In case of severe environmental exposure (as per IS 456:2000), what is the minimum grade of concrete recommended?

| (A) M20 | (B) M25 | (C) M30 | (D) M35 |
|---------|----------------|---------|---------|
| | | | |

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[Contd.

- 96. What is the critical path in a construction project?
 - (A) The longest sequence of activities in a project schedule
 - (B) The shortest path to complete the project
 - (C) The path with the most slack time
 - (D) The sequence of low-priority activities
- 97. What is "float" in project management?
 - (A) The total time a project can be delayed without impacting the completion date
 - (B) The time available to complete a task
 - (C) The time a task can be delayed without delaying the project
 - (D) The delay in resource allocation

98. Which act in India governs land acquisition for public infrastructure projects?

- (A) Real Estate Regulation Act (RERA)
- (B) The Land Acquisition, Rehabilitation and Resettlement Act, 2013
- (C) The Public Works Act, 1956
- (D) The Industrial Disputes Act, 1947

99. Which standard is followed for electrical wiring installations in buildings?

| (A) ASHRAE standards | (B) NEC (National Electrical Code) |
|----------------------|------------------------------------|
| (C) ASTM standards | (D) ISO 14001 |

100. Which of the following is a commonly used refrigerant in Heat Ventilation and Air Conditioning (HVAC) systems?

| (A) Water | (B) Ammonia |
|------------|----------------------|
| (C) R-134a | (D) Both (B) and (C) |

101. What does the "R" in the fire rating of building materials represent?

- (A) Resistance to thermal expansion
- **(B)** Resistance to collapse (structural integrity)
- (C) Resistance to fire spreading
- **(D)** Reflectivity of heat

102. The cost of formwork is generally expressed as a percentage of

- (A) Total labour cost (B) Total construction cost
- (C) Total cost of concrete work (D) Total project cost

- 103. What is the primary purpose of an Earnest Money Deposit (EMD) in tendering?
 - (A) To prevent frivolous bids
 - (B) To secure funds for the project
 - (C) To pay for project insurance
 - (D) To account for project escalation

104. Environmental clearance for construction projects is required under which legislation in India?

- (A) The Air (Prevention and Control of Pollution) Act, 1981
- (B) The Environment (Protection) Act, 1986
- (C) The Forest Conservation Act, 1980
- (D) The Building Bye-Laws, 2016

105. What is a "dummy activity" in project network analysis?

- (A) An activity that does not consume time or resources but maintains logic in the network
- (B) An activity that requires minimal resources
- (C) An activity with the highest cost
- (D) An activity that is not part of the critical path
- 106. In a PERT chart, what is the formula for calculating the expected time (TE) of an activity?
 - (A) TE = (Optimistic time + Pessimistic time) / 2
 - (B) TE = (Most likely time \times 3 + Pessimistic time) / 4
 - (C) TE = (Optimistic time + 4 × Most likely time + Pessimistic time) / 6
 - (D) TE = (Optimistic time + Most likely time + Pessimistic time) / 3
- 107. In hot and dry climates, how should a building be oriented?
 - (A) Long walls facing north and south to minimize heat gain
 - (B) Long walls facing east and west to maximize sunlight
 - (C) Completely closed to minimize air movement
 - (D) Orientation is not important in hot climates
- 108. In low-cost housing, what is the benefit of rat-trap bond masonry?
 - (A) Increases the strength of walls
 - (B) Reduces the amount of bricks and mortar used
 - (C) Ensures a decorative finish
 - (D) Eliminates the need for skilled labour

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- 109. In project network analysis, which of the following statements about the Critical Path Method (CPM) is true?
 - (A) The critical path has the least total duration
 - (B) The critical path has the maximum amount of float
 - (C) The critical path is always the longest path in the network
 - (D) Any delay on the critical path will cause a delay in the entire project
- 110. If the total project duration is 120 days, and the project manager performs a "crash" on activity 1, reducing it from 15 days to 10 days, then the effect is
 - (A) The project duration decreases by 5 days
 - (B) The total float for the project increases
 - (C) The project schedule becomes more relaxed
 - (D) The project manager reduces costs, without affecting time
- 111. Assertion: The use of pre-stressed concrete reduces the overall dead weight of structural elements. Reason: Pre-stressing introduces internal forces in concrete that counteract the tensile forces created by external loads, thus reducing the need for thicker sections and allowing for lighter structures.
 - (A) Both Assertion and Reason are correct, and Reason is the correct explanation for Assertion.
 - (B) Both Assertion and Reason are correct, but Reason is not the correct explanation for Assertion.
 - (C) Assertion is correct, but Reason is incorrect.
 - (D) Assertion is incorrect, but Reason is correct.
- 112. A project has the following activities with the durations in days:
 - Activity A : Duration = 5 days
 - Activity B : Duration = 3 days (starts after A)
 - Activity C : Duration = 4 days (starts after A)
 - Activity D : Duration = 2 days (starts after B and C)

What is the total duration of the project in the Critical Path Method (CPM)?

- (A) 10 days (B) 12 days
- (C) 11 days (D) 13 days
- 113. What type of bond is typically used for walls of half-brick thickness?

| (A) English bond | (B) Flemish bond |
|--------------------|------------------|
| (C) Stretcher bond | (D) Header bond |

- 114. Which type of cofferdam is suitable for strong river currents?
 - (A) Cellular cofferdam (B) Single-wall cofferdam
 - (C) Earth-filled cofferdam (D) Sheet pile cofferdam

115. A hydraulic excavator has a bucket capacity of 1.5 cubic meters. The cycle time for excavation including loading is 30 seconds. If the job requires moving 10,000 cubic meters of soil with a swell factor of 1.25, then what is the total time required (in hours) assuming 90% efficiency?

| (A) 84.5 hours | (B) 77.2 hours |
|----------------|-----------------|
| (C) 92.6 hours | (D) 102.4 hours |

116. A vibratory roller has a width of 2 meters and a speed of 4 km/h. If the compaction efficiency is 80% and the overlap between passes is 10%, then how many square meters can the roller compact in 5 hours?

| (A) 25,600 m ² | (B) 32,000 m ² |
|----------------------------------|----------------------------------|
| (C) 36,000 m ² | (D) $28,800 \text{ m}^2$ |

117. A concrete mixer has a drum capacity of 0.3 cubic meters and the mixing time per batch is 5 minutes. If the mixer operates for 8 hours a day with an efficiency of 90%, then how much concrete can it produce in a day?

| (A) 25.92 m^3 | (B) 30.24 m ³ |
|-------------------------|---------------------------------|
| (C) 34.56 m^3 | (D) 38.88 m ³ |

118. Which equipment is used for compaction in areas where large rollers cannot reach?

- (A) Vibratory plate compactor
- (B) Smooth drum roller
- (C) Sheep foot roller

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- (D) Pneumatic tire roller
- 119. A diaphragm wall is constructed using

| (A) Auger drill rigs | (B) Hydraulic trench cutters |
|------------------------|------------------------------|
| (C) Backhoe excavators | (D) Draglines |

120. Which type of glass allows sunlight but blocks heat radiation?

| (A) Frosted glass | (B) Low emissivity glass |
|-------------------|--------------------------|
| (C) Tinted glass | (D) Wired glass |

121. The matrix material in FRP composites is usually made of

| (A) Steel | (B) Concrete |
|-----------------|--------------|
| (C) Epoxy resin | (D) Glass |

- 122. What device is used to protect against leakage current and prevent electric shocks?
 - (A) MCB (Miniature Circuit Breaker)
 - (B) Fuse
 - (C) Transformer
 - (D) RCCB (Residual Current Circuit Breaker)
- 123. The optimistic, most likely and pessimistic time estimates of an activity are 5, 10 and 21 days respectively. What is the expected time and standard deviation?
 - (A) 12, 3 (C) 11, 2.67 (D) 10, 16
- 124. In prefabricated steel structures, which type of connection provides the highest resistance to seismic forces?
 - (A) Bolted shear connection (B) Welded moment connection
 - (C) Simple pin connection (D) Friction-grip bolted connection
- 125. In earthquake-prone regions, how does building orientation influence structural stability?
 - (A) Aligning the building perpendicular to fault lines reduces damage
 - (B) Orienting the building parallel to prevailing winds minimizes lateral forces
 - (C) Rotating the structure 30° from cardinal directions reduces seismic amplification
 - (D) The orientation has no significant effect on earthquake resistance
- 126. The optimal orientation for photovoltaic (PV) panels in the Southern Hemisphere is
 - (A) Facing true north (B) Facing true south
 - (C) Facing east (D) Facing west
- 127. The effectiveness of daylighting strategies is most influenced by which of the following orientation factors?
 - (A) Latitude of the building site
 - (B) Distance from the equator
 - (C) Azimuth angle of the sun throughout the year
 - **(D)** Window glazing properties
- 128. Which of the following structural materials exhibits the highest fire resistance in terms of integrity and insulation properties?
 - (A) Structural steel with intumescent coating
 - (B) Timber with fire-retardant treatment
 - (C) Aluminum alloy with thermal barriers
 - **(D)** Reinforced concrete

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- 129. Marble is formed by metamorphosis of
 (A) Limestone
 (I
 - (A) Limestone(B) Sandstone(C) Shale(D) None of these

130. If a 3 × 3 pile group has piles of diameter 0.5 m with c/c spacing of 0.75 m, then the dimension of the pile group is

| $(\mathbf{A}) 2 \mathbf{m} \times 2 \mathbf{m}$ | (B) 3 m × 3 m |
|---|-------------------|
| (C) 2.25 m × 2.25 m | (D) none of these |

131. In a hydrometer analysis, for estimating particle size distribution of fine-grained soil, it is assumed that

- (A) All particles are of same specific gravity
- (B) Terminal velocity is attained immediately after starting the test
- (C) The test is applicable for colloid sized particles
- (D) Both (A) and (B)

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132. A soil classified as gravel with Cc between 1 and 3 will be classified as well-graded, if

| (A) $Cu \ge 4$ | (B) Cu < 4 |
|----------------|-------------------|
| (C) $Cu > 6$ | (D) None of these |

133. Which of the following is considered as transported soils?

| (A) Alluvial soil | (B) Aeolian soil |
|-------------------|------------------|
| (C) Marine soil | (D) All of these |

- 134. Source of negative charge in clay minerals is attributed to
 - (A) Isomorphous substitution
 - (B) Crystal imperfections and broken bonds
 - (C) Proton dissolution of exposed OH groups in basic environment
 - **(D)** All of these

135. If 2.20% of soil is retained on 4.75 mm sieve and 37.36% is retained on the pan after passing the 75 micron sieve, then the sand fraction is

| (A) 2.20 % | (B) 37.36 % |
|-------------|-------------|
| (C) 60.44 % | (D) 35.16 % |

136. If relative density of sand is greater than 70%, then the expected method of failure to be considered for estimating bearing capacity of a shallow foundation is

| (A) local shear | (B) general shear |
|--------------------|-------------------|
| (C) punching shear | (D) Interpolate |

137. Specific surface area of 700 m²/g could be possible for which of the following clay minerals?

| 13/. | 7. Specific surface area of 700 m ² /g could be possible for which of the following clay minerals? | |
|---|---|----------------------------------|
| | (A) Quartz | (B) Kaolinite |
| | (C) Illite | (D) Montmorillonite |
| 138. A rounded soil particle of 10 mm diameter would be considered as | | Ild be considered as |
| | (A) Sand | (B) Silt |
| | (C) Gravel | (D) Cobble |
| 139. | Net charge on quartz present in sand is | |
| | (A) –2 | (B) –1 |
| | (C) –3 | (D) 0 |
| 140. | In soil classification, the symbol M is used for | |
| | (A) Clay | (B) Silt |
| | (C) Gravel | (D) Sand |
| 141. | 41. Swelling potential of Illite is significantly less than that of montmorillonite due to | |
| | (A) Potassium bond | (B) van der Waals force |
| | (C) Hydrogen bond | (D) None of these |
| 142. | 2. If specific gravity marked on a hydrometer stem is 1.010, then the corresponding hydro reading is | |
| | (A) 10 | (B) 1 |
| | (C) 1.010 | (D) None of these |
| 143. | 43. During a hydrometer test for grain size distribution of fine-grained soil, the hydrometer r | |
| | versus time | |
| | (A) Increases | (B) Decreases |
| | (C) Remains constant | (D) Increases and then decreases |
| 144. | If consistency index of a soil is less than 0, then | it would behave like |
| | (A) Liquid | (B) Solid |
| | (C) Semi-solid | (D) Plastic |
| 145. | If a soil has PI of 50 and clay fraction of 10%, | then it will be considered as |
| | (A) Inactive | (B) Normal |

(C) Active (D) None of these

| 146. | . If loose sand is subjected to drained shearing, then which of the following is applicable? | |
|------|--|---|
| | (A) volume change = 0 cc | |
| | (B) excess pore water pressure = 0 kPa | |
| | (C) excess pore water pressure > 0 kPa | |
| | (D) excess pore water pressure < 0 kPa | |
| 147. | Sensitivity is less than one for | |
| | (A) Fissured clay | (B) Sensitive clay |
| | (C) Normal clay | (D) Quick clay |
| 148. | Which of the following soil classification symbol | l is not possible? |
| | (A) CH | (B) SP |
| | (C) CW | (D) GW |
| 149. | 9. As per Terzaghi, the ratio of depth of a shallow foundation to its width is | |
| | $(\mathbf{A}) \leq 1$ | (B) > 10 |
| | (C) > 4 | (D) None of these |
| 150. | As per AASHTO soil classification, group index | x is applicable for which of the following group? |
| | (A) A-1 | (B) A-2 |
| | (C) A-3 | (D) A-4 |
| 151. | As per ISSCS, fine gravel is of size | |
| | (A) 4.75 mm to 19 mm | (B) 4.75 mm to 20 mm |
| | (C) 19 mm to 75 mm | (D) 20 mm to 80 mm |
| 152. | As per USCS, a soil is classified as organic soil if ratio of LL after oven drying to that before over | |
| | drying is | |
| | (A) < 0.75 | (B) > 0.75 |
| | (C) < 0.5 | (D) > 0.5 |
| 153. | The meniscus correction in hydrometer analysi | s is |
| | (A) Always positive | (B) Always negative |
| | (C) Zero | (D) Can be either positive or negative |
| 154. | The dispersing agent correction in hydrometer | analysis is |
| | (A) Always positive | (B) Always negative |
| | (C) Zero | (D) Can be either positive or negative |

| 155. | 5. If liquidity index of a soil is greater than 1, it would have consistency of a | |
|------|---|--|
| | (A) Liquid | (B) Solid |
| | (C) Semi-solid | (D) Plastic |
| 156. | The degree of saturation on ZAV line is | |
| | (A) 80% | (B) 50% |
| | (C) 0% | (D) 100% |
| 157. | 7. The soil fabric on the wet side of optimum is typically | |
| | (A) Flocculated | (B) Dispersed |
| | (C) Either dispersed or flocculated | (D) None of these |
| 158. | The temperature correction in hydrometer ana | llysis is |
| | (A) Always positive | (B) Always negative |
| | (C) Zero | (D) May be either positive or negative |
| 159. | 9. The tests needed for soil classification as per USCS is/are | |
| | (A) Only Sieve analysis | |
| | (B) Only Atterberg limits | |
| | (C) Sieve analysis and Atterberg limits | |
| | (D) Sieve analysis, Hydrometer analysis and Atterberg limits | |
| 160. | 0. If a soil is susceptible to swelling, it should be compacted at | |
| | (A) OMC | (B) Wet of optimum |
| | (C) Dry of optimum | (D) None of these |
| 161. | 1. In the sand replacement method for estimating field density, the standard sand used is | |
| | (A) Gap-graded | (B) Well-graded |
| | (C) Uniformly-graded | (D) None of these |
| 162. | 2. The pore water pressure on the phreatic surface is | |
| | (A) 0 kPa (absolute) | (B) 0 kPa (gauge) |
| | (C) 100 kPa (gauge) | (D) None of these |
| 163. | If porosity of a soil specimen is 50%, then the s | seepage velocity is |
| | (A) same as superficial velocity | (B) twice the superficial velocity |
| | (C) half the superficial velocity | (D) none of these |

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164. If the density of soil solids is 2.65 gm/cc and void ratio is 1, then the critical hydraulic gradient is (A) 0.825 **(B) 1.012** (C) 0.925 (D) none of these 165. The shrinkage limit of a soil in the water content at which its consistency transitions from (A) Solid to semi-solid (B) Semi-solid to plastic (C) Plastic to liquid (D) None of these 166. If the critical hydraulic gradient is 1, then the submerged unit weight is (A) 9.81 kN/m^3 (B) 9.01 kN/m³ (C) 10.21 kN/m^3 (D) None of these 167. The Boussinesq's equation assumes the soil to be (A) Elastic and isotropic (B) Weightless (D) All of these (C) Homogeneous 168. If the hydraulic gradient is 0.5, then the seepage force/volume is (B) 4.905 kN/m^3 (A) 9.81 kN/ m^3 (C) 19.62 kN/m^3 (D) None of these 169. The point load carrying capacity of a 0.5 m diameter pile resting on a saturated clay layer having undrained shear strength of 200 kPa is (A) 353.4 kN (B) 253.4 kN (C) 314.2 kN (D) None of these 170. A fine-grained soil with LL of 20 and PI of 6 will be classified as (A) MH **(B)** CH (C) CL - ML (D) CL 171. The Poisson's ratio for a saturated clayey soil under undrained loading condition is (A) 0.25 (B) 0.33 (C) 0.5 (D) None of these 172. If the corrected blow counts between base of footing and depth equal to 2 times width of footing are 13, 17, 20, 25 and 45, then the individual corrected blow count that should be neglected for estimation of bearing capacity of shallow foundation as per IS 6403 is (A) 13 **(B) 25** (C) 45 (D) None of these

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173. The time factor corresponding to average degree of consolidation of 90%, assuming constant increase in excess pore water pressure with depth at the time of loading is

| (A) 0.848 | (B) 0.197 | |
|-----------|-------------------|--|
| (C) 0.286 | (D) None of these | |

174. For the field plate load test as per IS 1888, the pit width is generally equal to

| (A) 5 times width of test plate | (B) width of test plate |
|---------------------------------|-------------------------|
|---------------------------------|-------------------------|

(C) 2 times width of test plate (D) none of these

175. Dilatancy correction for obtaining corrected SPT blow count is applicable for

- (A) fine sand and silt below water table with N > 15
- (B) soft clay below water table with N > 15
- (C) fine sand and silt above water table with N > 15
- (D) none of the above
- 176. The field and laboratory compression curves meet at void ratio equal to

| (A) 0.52e _o | (B) 0.42e _o |
|------------------------|------------------------|
| (C) $0.32e_0$ | (D) none of these |

177. In an eccentrically loaded footing, if eccentricity e = width (B)/6, then the minimum stress below the footing (qmin) is

| (A) 0 kPa | (B) < 0 kPa |
|-------------|-------------------|
| (C) > 0 kPa | (D) None of these |

178. Meyerhof's effective area method is used for estimating bearing capacity of

- (A) laterally loaded pile
- (B) eccentrically loaded shallow foundation
- (C) uplift capacity of pile
- (D) none of these

179. The shape of radial shear zones below a shallow footing is

| (A) Circular | (B) Parabolic |
|--------------|---------------|
|--------------|---------------|

(C) Logarithmic spiral (D) None of these

180. The Fox correction is incorporated into the settlement calculation for shallow foundations to account for the effect of

- (A) Depth of embedment (B) Presence of shallow rigid layer
- (C) Anisotropy of the soil (D) None of these

181. If the rigidity index of soil is less than the critical rigidity index, then the soil compressibility factors are

(A) 0, 0, 0 (B) 1, 1, 1(C) < 1, < 1, < 1 (D) > 1, > 1, > 1

182. If the unit skin friction is f_{av}, length L and diameter of circular pile is D, then the expression for frictional resistance exerted by the soil on the pile is

| (A) $\mathbf{f}_{av} \times \mathbf{L} \times \boldsymbol{\pi} \times \mathbf{D}$ | (B) $\mathbf{f}_{av} \times \mathbf{L} \times \mathbf{D}$ |
|---|---|
| (C) $f_{av} \times \pi \times D^2/4$ | (D) None of these |

183. If a soil has effective friction angle of 30°, then the at-rest lateral earth pressure coefficient is

(A) 0.33
(B) 0.5
(C) 1.5
(D) none of these

184. If the highest stress applied during a 1D consolidation test is 3.2 kg/cm² during the unloading stage, then the stress should be reduced to

| $(A) 0 \text{ kg/cm}^2$ | (B) 1.6 kg/cm ² |
|----------------------------|----------------------------|
| (C) 0.8 kg/cm ² | (D) None of these |

185. Which of the following slope stability analysis method satisfies both force and moment equilibrium?

| (A) Ordinary method of slices | (B) Bishop's simplified |
|-------------------------------|------------------------------|
| (C) Janbu's method | (D) Morgenstern-Price method |

186. According to Taylor's stability chart, the failure of all saturated clay slopes rising at an angle of more than 53 degree occurs along

| (A) Toe circle | (B) Mid-point circle |
|------------------|----------------------|
| (C) Slope circle | (D) None of these |

187. Engineering properties of a problematic CH soil has to improved. Which of the following ground improvement technique should be most preferrable?

- (A) Lime stabilization
- (B) Compaction using vibratory roller
- (C) Compaction using grid roller
- (D) None of the above

188. If the total stress = 100 kPa, hydrostatic pore water pressure = 30 kPa and excess pore water pressure during undrained shearing = 10 kPa, then the effective stress is

| (A) 100 kPa | (B) 70 kPa |
|-------------|-------------------|
| (C) 60 kPa | (D) None of these |

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- 189. Uplift pressure is considered in the analysis of gravity dams in which of the following situation?
 - (A) Only when there is a drainage gallery in the dam.
 - (B) Only when there is tail water.
 - (C) Only when the reservoir is empty.
 - **(D)** In all situations having water in the reservoir.
- 190. In gravity dam design, the horizontal 'silt and water' pressure is assumed as equivalent to that of a fluid with a mass density in kg/m³ of
 - (A) 360
 (B) 1000
 (C) 1360
 (D) 1925
- **191.** The amount of irrigation water required to meet the evapotranspiration needs of the crop during its full growth is
 - (A) effective rainfall
 - (B) consumptive use
 - (C) consumptive irrigation requirement
 - (D) net irrigation requirement
- 192. In a gravity dam, a grout curtain is usually provided
 - (A) near the toe to reduce the exit gradient
 - (B) in the middle of the base to reduce seepage
 - (C) near the heel to reduce uplift and seepage
 - (D) at the middle third of the base nearest to the toe to reduce the reaction pressure
- 193. An earthquake acceleration of 0.1 g acting vertically downward causes in a gravity dam
 - (A) an increase in the weight of dam by 10%
 - (B) a reduction in the unit weight of concrete only by 10%
 - (C) a decrease in the unit weights of concrete and water by 10%
 - (D) increase in the uplift pressure by 10%
- 194. A cross-drainage work is termed as a syphon, if it carries the canal
 - (A) above the drainage with the drainage flowing under pressure
 - (B) below the drainage with the canal flowing under pressure
 - (C) below the drainage with the canal flowing at atmospheric pressure under the works
 - (D) above the drainage with the drainage flowing at atmospheric pressure under the works.

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- 195. A level crossing type of cross-drainage work consists which of the following?
 - (A) one regulator only
 - (B) two weirs only

- (C) one weir and two regulators
- (D) two weirs and two regulators
- 196. A canal carries a discharge of 20 m³/s at a depth of 1.5 m and has its bed 3.5 m higher than the bed of a drainage it has to cross. If the drainage has a high flood depth of 2.5 m, then the type of cross drainage works appropriate to this site is
 - (A) Aqueduct

(B) Syphon aqueduct

(C) Syphon

(D) Super Passage

- 197. A canal is generally lined
 - (A) when it is in cutting
 - (B) when it is in embankment
 - (C) when it is partly in cutting and partly in embankment
 - (D) when bed and banks of canal consist of highly impervious soil
- 198. IHP stands for
 - (A) Intensive Hydraulic Press
 - (B) International Hydrologic Publications
 - (C) International Hydrologic Periodicals
 - (D) International Hydrologic Programme
- 199. In the case of a water table well, the piezometric surface
 - (A) is above the ground level
 - (B) is below the water level in the well
 - (C) coincides with the water level in the well
 - (D) is between the water level in the well and ground level
- 200. An aquifer which is underlain by an impermeable layer at the bottom and not confined at the top is known as
 - (A) Confined aquifer (B) Unconfined aquifer
 - (C) Semi-confined aquifer (D) Perched aquifer
- 201. A laboratory test on a sample from an aquifer revealed a porosity of 35%. The specific yield of the aquifer will be

| (A) equal to 0.35 | (B) less than 0.35 |
|--------------------|---------------------------|
| (C) more than 0.35 | (D) difficult to predict |

202. The surface obtained by joining the water levels in several observation well's penetrating a confined aquifer represents

| (A) Piezometric surface | (B) Water-Table surface |
|-------------------------|-------------------------|
| (C) Capillary fringe | (D) Cone of depression |

203. For a sphere falling at terminal velocity in the Stokes' law range, the drag coefficient C_D is given by

| (A) 24Re | (B) 64/Re |
|-----------|------------------------|
| (C) 24/Re | (D) 24 (1 + 3/16Re)/Re |

- 204. Pressure drag results due to
 - (A) Formation of wake
 - (B) Turbulence in the wake
 - (C) Existence of stagnation point in the front of a body
 - (D) High Reynolds numbers
- 205. In calculating the lift force,
 - (A) Always the frontal area is used
 - (B) Always the planform area is used
 - (C) Planform area is used if the body is a lifting surface
 - (D) Actual surface area of the body is used

206. The nominal distance of a boundary layer is defined as the distance from the wall to a point

- (A) Where the velocity is 99% less than the asymptotic limit
- (B) Where the velocity ceases to be laminar
- (C) Where the velocity is within 90% of the asymptotic limit
- (D) Where the velocity is 99% of its asymptotic limit
- 207. The mean drag coefficient (C_{Df}) for a laminar boundary layer along a flat plate was found to be 0.015. If all other flow factors remain the same and the length of the plate is decreased to ¼ of its original value, then the drag coefficient C_{DF} would be equal to

| (A) 0.015 | (B) 0.060 |
|------------------|------------------|
| | |

- (C) 0.030 (D) 0.0075
- 208. A retarding reservoir for flood control is the one which is provided with
 - (A) uncontrolled outlets and spillway
 - (B) uncontrolled outlets but controlled spillway
 - (C) controlled outlets but uncontrolled spillway
 - (D) controlled outlets and spillway

- 209. In a pipe network,
 - (A) the algebraic sum of discharges around each elementary circuit must be zero
 - (B) the head at each node must be the same
 - (C) the algebraic sum of the piezometric head drops around each elementary circuit is zero
 - (D) the piezometric head loss in each line of a circuit is the same
- 210. A pipe is connected in series to another pipe whose diameter is twice and the length is 32 times that of the first. The ratio of the frictional head losses for the first pipe to that of the second pipe by assuming both the pipes to have same frictional coefficient *f* is
 - (A) 8 (B) 4
 - (C) 2 (D) 1
- 211. Two tanks are connected in parallel by two pipes A and B of identical friction factors and lengths. If the size of pipe A is double than that of pipe B, then their discharges will be in the ratio of
 - (A) 2 (B) 4 (C) 5.66 (D) 32
- 212. Three pipes are connected in series. Then,
 - (A) the head loss in each pipe is the same
 - (B) the total discharge is the sum of the discharge in the individual pipes
 - (C) the discharge through each pipe is the same
 - (D) the Reynolds number for each pipe is the same
- 213. In a pipeline design, the usual practice is to assume that due to aging
 - (A) the effective roughness increases linearly with time
 - (B) the friction factor increases linearly with time
 - (C) the pipe becomes smoother with time
 - (D) the friction factor decreases linearly with time
- 214. Francis turbine is the one which is
 - (A) an impulse turbine
 - (B) a reaction turbine
 - (C) a tangential flow turbine
 - (D) an axial flow turbine
- 215. Cavitation is caused by
 - (A) high velocity
 - (C) low pressure

- (B) low barometric pressure
- (D) high pressure

- 216. Which of the following rules are used in choosing the repeating variables in dimensional analysis?
 - (A) Repeating variable should include the dependent variable
 - (B) Repeating variable should combine among themselves to form a dimensionless group
 - (C) Repeating variable should contain at least one dimensionless parameter
 - (D) Repeating variable should contain all the primary units used in describing the variables in the question.
- 217. Flow duration curve is a plot of
 - (A) Flow against its time of occurrence in chronological order.
 - (B) Flow in ascending order against percentage time in chronological order.
 - (C) Flow that equalled or exceeded against percentage time.
 - (D) Flow against duration of time for which it is sustained.
- 218. Field vane shear test is applicable for estimating which of the following?
 - (A) Undrained shear strength of saturated soft clay
 - (B) Drained shear strength of saturated soft clay
 - (C) Undrained shear strength of saturated dense clay
 - (D) None of the above
- **219.** Consider the following statements to reply further:
 - **1.** Pumps in series operation allow the head to increase.
 - 2. Pumps in series operation increase the flow rate.
 - 3. Pumps in parallel operation increase the flow rate.
 - 4. Pumps in parallel operation allow the head to increase.

Which of these statements are incorrect?

(A) 1 and 3 (B) 1 and 4 (C) 2 and 4 (D) 3 and 4

220. For a Hydroelectric project with reaction turbine, the draft tube at the exit from the turbine is
(A) always immersed in water

- (B) always above the water
- (C) may either be above or below the water
- (D) above or below the water depending on the unit speed of the turbine
- 221. Which one of the following phenomena in a pipe flow is termed as water hammer?
 - (A) The sudden rise of pressure in a long pipe due to sudden closure of valve.
 - (B) The rise of pressure in a pipe due to gradual closure of valve.
 - (C) The rise of negative pressure.
 - (D) The zero pressure in a pipe flow.

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- 222. Two pipe systems are said to be equivalent in their lengths when
 - (A) the friction factor and discharge are same in both the systems
 - (B) the same head loss is produced by the same discharge in both the systems
 - (C) both the systems are in series

- (D) the discharge and diameter are same in both the systems
- 223. The distorted models used in the hydraulic studies are those which
 - (A) have exaggeration of the vertical scale and horizontal scale.
 - (B) are not geometrically similar to the prototypes.
 - (C) have same vertical and horizontal scale as that of the prototypes.
 - (D) have same Froude number as that for the prototypes.
- 224. Which one of the following statements is not correct?
 - (A) Cavitation forms where the local pressure drops up to the vapour pressure condition due to increase in local velocity.
 - (B) Cavitation takes place in turbines, runners of pumps and spillways where local velocity increases considerably.
 - (C) Cavitation may be prevented by maintaining the ambient pressure relatively higher at probable points of occurrence by raising their levels.
 - (D) Boundaries likely to be affected by cavitation can be prevented against pitting by covering it with tough materials like stainless steel or rubber
- 225. Which of the following fluids can be classified as non-Newtonian?
 - 1. Kerosene oil
 - 2. Diesel oil
 - 3. Human blood
 - 4. Tooth paste
 - 5. Water

Select the correct answer from the code given below:

| (A) 1 and 2 | (B) 3 and 4 |
|-------------|--------------------|
| (C) 2 and 5 | (D) 1 and 5 |

226. Which of the following is correct?

If the number of jets in a Pelton turbine is n then the specific speed is proportional to

- (A) n² (B) n
- (C) $n^{\frac{1}{2}}$ (D) n^{0}

227. The ratio of actual discharge to theoretical discharge through an orifice is

(A)
$$C_c / C_v$$

(B) C_c / C_d
(C) C_v / C_d
(D) C_d / C_v

228. A pump and its (1/4) scale model are being compared. If the ratio of the heads is 5:1, then the ratio of the power consumed by the prototype and the model is

- (A) 100 (B) 3.2
- (C) 179 (D) 12.8

229. Two pumps identical in all respects and each capable of delivering a discharge, against a head H are connected in series, the resulting discharge is

- (A) 2Q against a head 2H (B) 2Q against a head H
- (C) Q against a head 2H (D) \sqrt{Q} against a head $\sqrt{2}$ H
- 230. In a single reciprocating pump without air vessel, the ratio of the average friction head to the maximum friction head in the delivery pipe is given by hfda / hfdm =

| (A) 1/ 2 | (B) 1/3 |
|----------|----------|
| (C) 2/3 | (D) 3/ 2 |

231. A similar model of a pump is built to a ratio of 1:2. If the model pumps has the same fluid as the prototype at the same rotative speed, then the ratio of model power to prototype power input is

- (A) $1/2\sqrt{2}$ (B) 1/32
- (C) 1/8 (D) $1/16\sqrt{2}$
- 232. A fast centrifugal pump impeller will have
 - (A) forward facing blades

(B) radial blades

- (C) backward facing blades
- (D) propeller type blades
- 233. In all reaction turbines, maximum efficiency is obtained if (Note: All angles are measured with respect to the direction of the peripheral velocity.)
 - (A) the guide vane angle is 90°
 - (B) the blade angle of the runner is 90° at the inlet
 - (C) the blade angle of the runner is 90° at the outlet
 - (D) the angle of the absolute velocity vector at the outlet is 90°

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234. In the analysis of networks of pipes,

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- (A) the head loss around each elementary circuit must be zero
- (B) the head loss in all circuits is the same
- (C) the elevation of hydraulic grade line is assumed for each junction
- (D) elementary circuits are replaced by equivalent pipes.
- 235. Two hydraulic turbines are similar and homologous, when they are geometrically similar and have
 - (A) the same Thoma number
 - (B) the same Froude number
 - (C) the same specific speed
 - (D) the same rotational speed
- 236. For a 1:m scale model of a turbine, the specific speed of the model N_{sm} is related to the prototype specific speed N_{sm} as N_{sm} =

| (A) N _{sp} /m | (B) mN _{sp} |
|------------------------|-------------------------------|
| (C) N _{sp} | (D) $(N_{sp})^{1/m}$ |

- 237. The net available head H in a Pelton turbine installation is the
 - (A) kinetic energy of the jet issuing from nozzle
 - (B) difference in elevation between forebay water level and the nozzle outlet
 - (C) head at the base of the nozzle
 - (D) difference in level between water levels at the forebay and the tailwater level
- 238. In the Francis turbine, the runner blades are radial at the entrance and the discharge is radial at the outlet. For this turbine,
 - (A) the relative velocity is radial at the outlet
 - (B) the absolute velocity is radial at the outlet
 - (C) the guide vane angle is 90°
 - **(D)** the velocity of flow is constant
- 239. Consider the following statements:
 - 1. Run-of-river plants can be located on any river.
 - 2. Runaway speed of a turbine is generally 180% of the normal speed
 - 3. Underground power stations are suited to areas susceptible to landslides.
 - 4. Higher the specific speed, higher will be the discharge and head.
 - Which of these statements are correct?
 - (A) 1 and 2 (B) 2 and 3 (C) 1 and 4 (D) 2 and 4

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- 240. The head-discharge characteristic curve of two centrifugal pumps in
 - 1. parallel can be obtained by doubling the ordinates
 - 2. series can be obtained by doubling the abscissa

Which of these statements is/are correct?

- (A) 2 alone (B) 1 alone
- (C) Neither 1 nor 2 (D) Both 1 and 2
- 241. Consider the following statements related to concept of continuity equation and the concept of control volume in deriving equation.
 - 1. Continuity equation relates velocity component and density of the fluid at a point in a fluid flow.
 - 2. Continuity equation assumes that no void occurs in the fluid and fluid mass is neither created nor destroyed
 - **3.** The shape of control volume for deriving the equation of continuity is assumed to be a parallelepiped
 - 4. For incompressible fluids, the equation of continuity does not contain the viscosity terms. Which of these statements are correct?
 - (A) 1, 2, 3 and 4 (B) Both 1 and 2
 - (C) 2, 3 and 4 (D) Both 1 and 4
- 242. The runoff may be indirectly estimated by
 - 1. empirical formulae relating rainfall and runoff
 - 2. infiltration method
 - **3.** rational method and
 - 4. unit hydrograph method
 - (A) 1 and 2
 (B) 2 and 3

 (C) 3 and 4
 (D) 1, 2, 3 and 4
- 243. For the measurement of rainfall, rain gauges are used which may be
 - 1. non-recording type
 - 2. recording type
 (A) Both 1 and 2
 (B) 1 only
 (C) 2 only
 (D) None of these

244. Mean depth of rainfall over an area may be obtained by

- 1. Arithmetic mean method
- 2. Theissen polygon method
- 3. Isohyetal method

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 (A) 1 and 2
 (B) 2 and 3

 (C) 3 and 4
 (D) 1, 2 and 3

245. The hydropower plants may be classified according to the storage being provided or not as

- 1. Run-of-river plants
- 2. Reservoir plants
- 3. Pumped storage plants
- 4. Tidal plants

| (A) 1, 2, 3 and 4 | (B) 1 and 2 |
|-------------------|--------------------|
| (C) 2 and 3 | (D) 3 and 4 |

246. Depending on the shape, size and composition of the sediment particles and the velocity of the flowing water, the sediment particles are transported in which of the following modes?

- 1. Sliding or rolling along the bed
- 2. Saltation or skipping
- 3. Movement in suspension

| (A) 1, 2 and 3 | (B) 1 and 2 |
|----------------|-------------------|
| (C) 2 and 3 | (D) None of these |

- 247. The vertical component of pressure force on a submerged curved surface is equal to
 - (A) its horizontal component
 - (B) the force on a horizontal projection of the curved surface
 - (C) the weight of the liquid vertically above the curved surface
 - (D) the product of the pressure at centroid and surface area
- 248. A control volume refers to which of the following?
 - (A) a fixed region in space(B) a specified mass(C) a closed system(D) a reversible process only
- 249. Conveyance of a channel section is directly proportional to which of the following?
 - (A) Discharge(B) Area of cross-section(C) Bed-slope(D) Manning's coefficient

250. Hydraulic jump can be used for

| (A) increasing the depth of flow | (B) reducing the energy of flow |
|----------------------------------|---------------------------------|
|----------------------------------|---------------------------------|

- (C) decreasing the velocity of flow (D) reducing turbulence
- 251. The hammer weight for performing SPT as per IS 2131 is
 - (A) 73.5 kg (B) 63.5 kg
 - (C) 53.5 kg (D) None of these
- 252. A normal shock wave is analogous to
 - (A) an elementary wave in still liquid
 - (B) the hydraulic jump
 - (C) subcritical flow in open channel
 - (D) flow of liquid through an expanding nozzle.
- 253. The drag of a body moving in air at supersonic velocity
 - (A) is reduced by streamlining of the rear
 - (B) is increased by streamlining of the rear
 - (C) remains practically unchanged by streamlining of the rear
 - (D) is increased by streamlining of the front
- 254. The force exerted by a jet on a curved plate is
 - (A) less than that on flat plate
 - (B) equal to that on a flat plate
 - (C) more than that on a flat plate
 - (D) sometimes more and sometimes less than that on a flat plate
- 255. If a hydro plant operates under a head of 100 m, then it may be classified as a
 - (A) very high-speed plant(B) high head plant(C) medium head plant(D) low head plant

256. In a signal design as per the Indian Road Congress specifications, the sum of the ratios of normal flows to saturation flows of two directional traffic flows is 0.50. The optimum cycle length as per Webster method is 30 sec. Estimate the total lost time per cycle.

| (A) 5.67 sec | (B) 6.67 sec |
|--------------|--------------|
| (C) 7.67 sec | (D) 8.67 sec |

257. According to the Indian Road Congress guidelines, what is the value of height of object above road surface for measurement of stopping sight distance?

| (A) 0.10 m | (B) 0.15 m |
|------------|-------------------|
| (C) 0.20 m | (D) 0.25 m |

258. A vehicle is moving on a highway at a speed of 60 kmph. The coefficient of friction between the road surface and the tyres is 0.35 and the reaction time of the driver is 2.5 sec. Estimate the lag distance.

| (A) 39.7 m | (B) 40.7 m |
|-------------------|------------|
| (C) 41.7 m | (D) 42.7 m |

259. The speed of overtaking and overtaken vehicles are 20 m/s and 10 m/s respectively. The time taken in overtaking operation is 8 sec. The reaction time for overtaking is 2.0 sec. Calculate the safe overtaking sight distance for the one-way road.

| (A) 124 m | (B) 125 m |
|-----------|-----------|
| (C) 126 m | (D) 127 m |

260. The speed of overtaking vehicle on a two-way road is 27.0 m/s. The time taken in overtaking operation is 6 sec. The reaction time for overtaking is 2.0 sec. Estimate the desirable length of overtaking zone for the two-way road.

| (A) 1924.5 m | (B) 1927.5 m |
|--------------|---------------------|
| (C) 1930.5 m | (D) 1933.5 m |

261. The speed of overtaking and overtaken vehicles are 26 m/s and 10 m/s respectively. The time taken in overtaking operation is 8 sec. The reaction time for overtaking is 2.0 sec. Estimate the minimum length of overtaking zone for the two-way road.

| (A) 996 m | (B) 998 m |
|------------|------------|
| (C) 1000 m | (D) 1002 m |

262. What will be the value of head light sight distance for a road having a stopping sight distance of 160 m?

| (A) 100 m | (B) 120 m |
|-----------|-----------|
| (C) 140 m | (D) 160 m |

263. Calculate the superelevation for a horizontal curve provided with a radius of 400 m for a design speed of 100 kmph in plain terrain.

| (A) 0.04 | (B) 0.07 |
|-----------------|-----------------|
| (C) 0.10 | (D) 0.11 |

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264. Calculate the extra widening required on a two-lane road having a horizontal curve of radius 100 m if the longest wheel base of vehicle expected on the road is 6.0 m. Design speed is 95 kmph.

| (A) 1.30 m | (B) 1.33 m |
|------------|------------|
| (C) 1.36 m | (D) 1.39 m |

265. Which of the following is the correct sequence of layers used in rigid pavement from top to bottom?

- (A) PQC layer, subgrade, dry lean concrete layer, subbase layer
- (B) Dry lean concrete layer, PQC layer, subbase layer, subgrade
- (C) PQC layer, dry lean concrete layer, subbase layer, subgrade
- (D) Subbase layer, PQC layer, dry lean concrete layer, subgrade
- 266. Which of the following is the correct value of maximum superelevation to be provided for roads in urban areas?

| (A) 2% | (B) 4% |
|--------|---------------|
| (C) 7% | (D) 10% |

267. Spot speed of vehicles observed at a point on a highway are 40, 50 and 25 km/h. What will be the space mean speed of observed vehicles?

| (A) 32 km/h | (B) 33 km/h |
|-------------|-------------|
| (C) 34 km/h | (D) 35 km/h |

268. The space headway between the vehicles moving on urban roads is 2 m. Estimate the maximum traffic density that a road can have under jam condition.

| (A) 400 veh/km | (B) 450 veh/km |
|----------------|----------------|
| (C) 500 veh/km | (D) 550 veh/km |

269. The capacity flow (per lane) was 3200 vehicles/hour. The free mean speed on a roadway is 80 kmph. Estimate the average spacing between the vehicles under stopped condition.

| (A) 6.05 m | (B) 6.15 m |
|------------|------------|
| (C) 6.25 m | (D) 6.35 m |

270. The speedy and cost-effective method for excavating long tunnel in hard and compact rock is

| (A) Tunnel boring machine | (B) Needle beam method |
|---------------------------|------------------------|
| (C) Compressed air method | (D) Shield method |

271. Drift method of tunnelling is used to construct tunnels in

| (A) Broken grounds | (B) Soft grounds |
|--------------------|------------------|
| (C) Plane grounds | (D) Rock |

272. Railway tunnels are generally

(A) Rectangular

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(B) Polycentric

- (C) Parabolic (D) Circular
- 273. Which of the following test parameter of subgrade soil is essential for the design of flexible pavement?
 - (A) California bearing ratio
 - (B) Maximum dry density
 - (C) Modulus of subgrade reaction
 - (D) Shear strength

274. The allowable rate of introduction of superelevation (pavement rotated about inner edge) is 1 in 60. The extra widening required at the curve is 1.0 m. The length of transition curve by assuming a safe superelevation rate of 0.07 is 21 m. Estimate the width of the pavement.

| (A) 3.5 m | (B) 4.0 m |
|-----------|------------------|
|-----------|------------------|

(C) 4.5 m (D) 5.0 m

275. A vehicle is travelling with a design speed of 90 kmph on a horizontal curve of radius 300 m and the coefficient of lateral friction is considered as 0.15. What is the superelevation if full lateral friction is assumed to be developed? (Assume plain and rolling terrain)

| (A) 0.0526 | (B) 0.0626 |
|-----------------|-------------------|
| (C) 0.07 | (D) 0.1 |

276. A vertical summit curve is formed by n1 = + 2.5% and n2 = - 2.5%. The available stopping sight distance is 120 m. Calculate the length of summit curve to meet the intermediate sight distance.

| (A) 280 m | (B) 300 m |
|------------------|-----------|
| (C) 320 m | (D) 340 m |

277. Which of the following is the equivalent axle load factor for a 160 kN axle load? (Assume the standard axle load of 80 kN)

| (A) 4 | (B) 8 |
|--------|---------------|
| (C) 12 | (D) 16 |

278. Estimate the theoretical capacity of traffic lane with one-way traffic flow at a stream speed of 60 kmph. Assume the average space gap between vehicles to follow the relation Sg = 0.278 V t where V is the stream speed in kmph, t is the average reaction time = 0.6 sec. Assume average length of vehicles = 5 m.

| (A) 3800 veh/hr | (B) 3900 veh/hr |
|-----------------|-----------------|
| (C) 4000 veh/hr | (D) 4100 veh/hr |

279. The values of warping stress coefficient Cx and Cy are 0.8 and 0.5 respectively. The modulus of elasticity of concrete is 3*10⁵ kg/cm². Assume thermal coefficient of concrete = 10*10⁻⁶ per °C. The maximum temperature difference between the top and bottom of the slab during summer day and night is found to be 18°C. Estimate the maximum warping stress at the edge region.

| (A) 21.0 kg/cm ² | (B) 21.2 kg/cm^2 |
|-----------------------------|-----------------------------|
| (C) 21.4 kg/cm ² | (D) 21.6 kg/cm ² |

280. The unit weight of the concrete is 2500 kg/m³. The allowable stress in tension in cement concrete is 0.8 kg/cm². The coefficient of friction is 1.5. Estimate the spacing between the contraction joint for plain cement concrete slab.

| (A) 3.67 m | (B) 4.27 m |
|------------|-------------------|
| (C) 4.87 m | (D) 5.47 m |

281. The values of warping stress coefficient Cx and Cy are 0.87 and 0.72 respectively. The modulus of elasticity of concrete is 3*10⁵ kg/cm². Assume thermal coefficient of concrete = 10*10⁻⁶ per °C. The maximum temperature difference between the top and bottom of the slab during summer day and night is found to be 15°C. The Poisson's ratio of concrete is 0.15. Estimate the warping stress at the interior region.

| (A) 22.5 kg/cm ² | (B) 23.0 kg/cm ² |
|-----------------------------|-----------------------------|
| (C) 23.5 kg/cm ² | (D) 24.0 kg/cm ² |

282. The value of minimum time headway is 2.5 seconds. Estimate the maximum theoretical capacity of a traffic lane.

| (A) 1410 veh/hr | (B) 1420 veh/hr | |
|-----------------|-----------------|--|
| (C) 1430 veh/hr | (D) 1440 veh/hr | |

283. The average number of vehicles overtaking the test vehicle is 100 and the number of vehicles overtaken by the test vehicle is 44. The flow of vehicles in one direction of stream is 14 veh/min. The average journey time of test vehicle travelling with the stream is 6.5 min. Estimate the average journey time for all the vehicles in a traffic stream in the direction of flow.

| (A) 2.1 min | (B) 2.3 min |
|-------------|-------------|
| (C) 2.5 min | (D) 2.7 min |

284. The average journey time of test vehicle travelling with the stream is 6.5 min. The average journey time during trips against the stream is 8.5 min. The number of vehicles encountered in the stream while the test vehicle was moving against the traffic stream is 206, number of vehicles that had overtaken the test vehicle is 74 and the number of vehicles overtaken by the test vehicle is 10. Find the flow of the stream.

| (A) 15 veh/min | (B) 16 veh/min |
|----------------|----------------|
| (C) 17 veh/min | (D) 18 veh/min |

- 285. In a braking test, a vehicle travelling at a speed of 36 kmph was stopped by applying brakes fully and skid marks were 4.0 m in length. Determine the average skid resistance of the pavement surface. Assume $g = 10 \text{ m/sec}^2$.
 - (A) 1.25 (B) 1.30
 - (C) 1.35 (D) 1.40
- 286. A vehicle moving at 54 kmph speed was stopped by applying a brake and the length of the skid marks was 25 m. If the average skid resistance of the pavement is known to be 0.50, then determine the brake efficiency of the test vehicle. Assume $g = 10 \text{ m/sec}^2$.

| (A) 88% | (B) 90% |
|---------|----------------|
| (C) 92% | (D) 94% |

287. A cement concrete pavement of thickness 25 cm has two lanes of 7.2 m with a longitudinal joint along the centre. The value of allowable working stress in tension is 1800 kg/cm². Assume unit weight of concrete = 2400 kg/m³ and coefficient of friction = 1.5. Estimate the area of steel per meter of longitudinal joint.

| (A) $1.2 \text{ cm}^2/\text{m}$ | (B) $1.5 \text{ cm}^2/\text{m}$ |
|---------------------------------|---------------------------------|
| (C) 1.8 cm ² /m | (D) $2.1 \text{ cm}^2/\text{m}$ |

288. A fixed time 2-phase signal is to be provided at an intersection having four arms. The design hour traffic and saturation flow are as under:

| | North (N) | South (S) | East (E) | West (W) |
|------------------|-----------|-----------|----------|----------|
| Design hour flow | 800 | 400 | 750 | 600 |
| Saturation flow | 2400 | 2000 | 3000 | 3000 |

The time lost per phase due to starting delays is 2 seconds. Estimate the optimum signal cycle length.

| (A) 40 sec | (B) 45 sec |
|------------|------------|
| (C) 50 sec | (D) 55 sec |

289. The rise in water level due to the obstruction caused by bridge construction is called as

| (A) Runoff | (B) Highest flood level |
|----------------|-------------------------|
| (C) Free board | (D) Afflux |

290. A bridge has a linear waterway of 150 m constructed across a stream whose natural linear waterway is 250 meters. The average flood depth is 2.5 meters and the average flood discharge is 1500 m³ per second. Estimate the velocity of approach.

| (A) 2.0 m/sec | (B) 2.2 m/sec |
|---------------|---------------|
| (C) 2.4 m/sec | (D) 2.6 m/sec |

291. A bridge that is constructed across a river has 3 spans. The clear distance between the two piers of the bridge is 20 meters. The width of each pier of the bridge is 5 meters. Estimate the length of the bridge.

| (A) 70 m | (B) 75 m |
|----------|----------|
| (C) 80 m | (D) 85 m |

292. For a straight stream flow condition for bridge site, the value of design discharge is 650 m³ per second and the value of normal scour depth is 3.5 m. The value of constant for straight reach is 1.27. Estimate the maximum scour depth.

| (A) 4.40 m | (B) 4.45 m |
|------------|-------------------|
| (C) 4.50 m | (D) 4.55 m |

293. The value of constant of variation is 50. The average cost of construction of one pier of the bridge is Rs. 45000. Estimate the economic span of the bridge.

| (A) 24 m | (B) 26 m |
|----------|-----------------|
| (C) 28 m | (D) 30 m |

294. The value of maximum scour depth estimated using the Lacey's formula is 9.0 m. The bridge site is at right-angled bend. The value of constant for maximum depth of scour at right-angled bend is 2.0. Assume Lacey's silt factor for river bed as 1.0. Estimate the flood discharge under a bridge.

| (A) 831 m ³ /sec | (B) 841 m ³ /sec |
|-----------------------------|-----------------------------|
| (C) 851 m ³ /sec | (D) 861 m ³ /sec |

295. A bridge is proposed to be constructed across an alluvial stream carrying a discharge of 1600 m³/sec. Estimate the surface width of the river according to Lacey's regime theory.

(A) 190 m (B) 200 m

(C) 210 m (D) 220 m

296. Which tunnel ventilation is provided when the length of the tunnel is large?

| (A) Mechanical ventilation | (B) Natural ventilation |
|----------------------------|-------------------------|
| (C) Both (A) and (B) | (D) None of these |

297. Which of the following type of bridge does not fall under the classification of bridge according to type of superstructure?

| (A) Lift bridges | (B) Arch bridges |
|------------------------|--------------------------|
| (C) Suspension bridges | (D) Cable-stayed bridges |

298. For an IRC class A and B loading, the impact factor for steel bridges having span more than 45 meters is taken as

| (A) 0.148 | (B) 0.151 |
|------------------|-----------|
| (C) 0.154 | (D) 0.157 |

299. Which of the following force is not acting on the foundation of the bridge?

(A) Seismic force

Μ

- (B) Buoyancy force
- (C) Weight of superstructure
- (D) Self-weight of foundation

300. Which of the following is the design hourly traffic volume used for the roadway facility design?

- (A) 10th highest hourly volume
- (B) 25th highest hourly volume
- (C) 30th highest hourly volume
- (D) 50th highest hourly volume