

पुस्तिका में पृष्ठों की संख्या : 16
 Number of Pages in Booklet : 16
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 No. of Questions in Booklet : 100

NEAP-25

इस प्रश्न-पुस्तिका को तब तक न खोलें जब तक
 कहा न जाए। Do not open this Question
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Exam. Date 28.9.25

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Paper Code : 35

Sub : Civil Engineering

प्रश्न-पुस्तिका संख्या व बारकोड /

Question Booklet No. & Barcode

समय : 02:00 घण्टे + 10 मिनट अतिरिक्त*

अधिकतम अंक : 200

Time : 02:00 Hours + 10 Minutes Extra*

Maximum Marks : 200

प्रश्न-पुस्तिका के पेपर की सील/पॉलिथीन बैग को खोलने पर प्रश्न-पत्र हल करने से पूर्व परीक्षार्थी यह सुनिश्चित कर लें कि :

- प्रश्न-पुस्तिका संख्या तथा ओ.एम.आर. उत्तर-पत्रक पर अंकित बारकोड संख्या समान हैं।
- प्रश्न-पुस्तिका एवं ओ.एम.आर. उत्तर-पत्रक के सभी पृष्ठ व सभी प्रश्न सही मुद्रित हैं। समस्त प्रश्न, जैसा कि ऊपर वर्णित है, उपलब्ध हैं तथा कोई भी पृष्ठ कम नहीं है/ मुद्रण त्रुटि नहीं है। किसी भी प्रकार की विसंगति या दोषपूर्ण होने पर परीक्षार्थी वीक्षक से दूसरा प्रश्न-पत्र प्राप्त कर लें। यह सुनिश्चित करने की जिम्मेदारी अभ्यर्थी की होगी। परीक्षा प्रारम्भ होने के 5 मिनट पश्चात् ऐसे किसी दावे/आपत्ति पर कोई विचार नहीं किया जायेगा।
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 - All pages & Questions of Question Booklet and OMR Answer Sheet are properly printed. All questions as mentioned above are available and no page is missing/misprinted.
- If there is any discrepancy/defect, candidate must obtain another Question Booklet from Invigilator. Candidate himself shall be responsible for ensuring this. No claim/objection in this regard will be entertained after five minutes of start of examination.

परीक्षार्थियों के लिए निर्देश

1. प्रत्येक प्रश्न के लिये एक विकल्प भरना अनिवार्य है।
 2. सभी प्रश्नों के अंक समान हैं।
 3. प्रत्येक प्रश्न का मात्र एक ही उत्तर दीजिए। एक से अधिक उत्तर देने की दशा में प्रश्न के उत्तर को गलत माना जाएगा।
 4. OMR उत्तर-पत्रक इस प्रश्न-पुस्तिका के अन्दर रखा है। जब आपको प्रश्न-पुस्तिका खोलने को कहा जाए, तो उत्तर-पत्रक निकाल कर ध्यान से केवल नीले बॉल पॉइंट पेन से विवरण भरें।
 5. कृपया अपना रोल नम्बर ओ.एम.आर. उत्तर-पत्रक पर सावधानीपूर्वक सही भरें। गलत रोल नम्बर भरने पर परीक्षार्थी स्वयं उत्तरदायी होगा।
 6. ओ.एम.आर. उत्तर-पत्रक में करेक्शन पेन/व्हाइटनर/सफेदा का उपयोग निषिद्ध है।
 7. प्रत्येक गलत उत्तर के लिए प्रश्न अंक का 1/3 भाग काटा जायेगा। गलत उत्तर से तात्पर्य अशुद्ध उत्तर अथवा किसी भी प्रश्न के एक से अधिक उत्तर से है।
 8. प्रत्येक प्रश्न के पाँच विकल्प दिये गये हैं, जिन्हें क्रमशः 1, 2, 3, 4, 5 अंकित किया गया है। अभ्यर्थी को सही उत्तर निर्दिष्ट करते हुए उनमें से केवल एक गोले (बबल) को उत्तर-पत्रक पर नीले बॉल पॉइंट पेन से गहरा करना है।
 9. यदि आप प्रश्न का उत्तर नहीं देना चाहते हैं तो उत्तर-पत्रक में पाँचवें (5) विकल्प को गहरा करें। यदि पाँच में से कोई भी गोला गहरा नहीं किया जाता है, तो ऐसे प्रश्न के लिये प्रश्न अंक का 1/3 भाग काटा जायेगा।
 - 10.* प्रश्न-पत्र हल करने के उपरान्त अभ्यर्थी अनिवार्य रूप से ओ.एम.आर. उत्तर-पत्रक जाँच लें कि समस्त प्रश्नों के लिये एक विकल्प (गोला) भर दिया गया है। इसके लिये ही निर्धारित समय से 10 मिनट का अतिरिक्त समय दिया गया है।
 11. यदि अभ्यर्थी 10% से अधिक प्रश्नों में पाँच विकल्पों में से कोई भी विकल्प अंकित नहीं करता है तो उसको अयोग्य माना जायेगा।
 12. मोबाइल फोन अथवा अन्य किसी इलेक्ट्रॉनिक यंत्र का परीक्षा हॉल में प्रयोग पूर्णतया वर्जित है। यदि किसी अभ्यर्थी के पास ऐसी कोई वर्जित सामग्री मिलती है तो उसके विरुद्ध आयोग द्वारा नियमानुसार कार्यवाही की जायेगी।
- चेतावनी :** अगर कोई अभ्यर्थी नकल करते पकड़ा जाता है या उसके पास से कोई अनधिकृत सामग्री पाई जाती है, तो उस अभ्यर्थी के विरुद्ध पुलिस में प्राथमिकी दर्ज कराते हुए राजस्थान सार्वजनिक परीक्षा (भर्ती में अनुचित साधनों की रोकथाम अध्याय) अधिनियम, 2022 तथा अन्य प्रभावी कानून एवं आयोग के नियमों-प्रावधानों के तहत कार्यवाही की जाएगी। साथ ही आयोग ऐसे अभ्यर्थी को भविष्य में होने वाली आयोग की समस्त परीक्षाओं से विवर्जित कर सकता है।

INSTRUCTIONS FOR CANDIDATES

1. It is mandatory to fill one option for each question.
2. All questions carry equal marks.
3. Only one answer is to be given for each question. If more than one answers are marked, it would be treated as wrong answer.
4. The OMR Answer Sheet is inside this Question Booklet. When you are directed to open the Question Booklet, take out the Answer Sheet and fill in the particulars carefully with Blue Ball Point Pen only.
5. Please correctly fill your Roll Number in OMR Answer Sheet. Candidates will themselves be responsible for filling wrong Roll No.
6. Use of Correction Pen/Whitener in the OMR Answer Sheet is strictly forbidden.
7. 1/3 part of the mark(s) of each question will be deducted for each wrong answer. A wrong answer means an incorrect answer or more than one answers for any question.
8. Each question has five options marked as 1, 2, 3, 4, 5. You have to darken only one circle (bubble) indicating the correct answer on the Answer Sheet using BLUE BALL POINT PEN.
9. If you are not attempting a question then you have to darken the circle '5'. If none of the five circles is darkened, one third (1/3) part of the marks of question shall be deducted.
- 10.* After solving question paper, candidate must ascertain that he/she has darkened one of the circles (bubbles) for each of the questions. Extra time of 10 minutes beyond scheduled time, is provided for this.
11. A candidate who has not darkened any of the five circles in more than 10% questions shall be disqualified.
12. Mobile Phone or any other electronic gadget in the examination hall is strictly prohibited. A candidate found with any of such objectionable material with him/her will be strictly dealt with as per rules.

Warning : If a candidate is found copying or if any unauthorized material is found in his/her possession, F.I.R. would be lodged against him/her in the Police Station and he/she would be liable to be prosecuted under Rajasthan Public Examination (Measures for Prevention of Unfair means in Recruitment) Act, 2022 & any other laws applicable and Commission's Rules-Regulations. Commission may also debar him/her permanently from all future examinations.

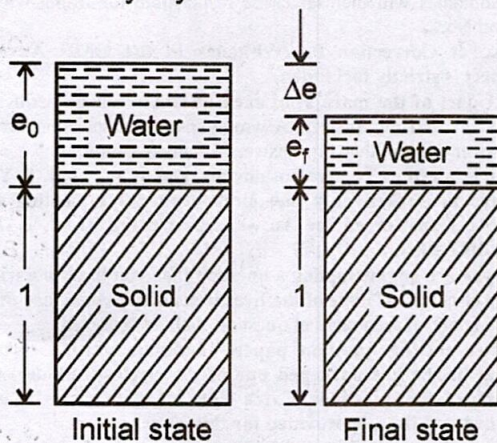
उत्तर-पत्रक में दो प्रतियाँ हैं - मूल प्रति और कार्बन प्रति। परीक्षा समाप्ति पर परीक्षा कक्ष छोड़ने से पूर्व परीक्षार्थी उत्तर-पत्रक की दोनों प्रतियाँ वीक्षक को सौंपेंगे, परीक्षार्थी स्वयं कार्बन प्रति अलग नहीं करें। वीक्षक उत्तर-पत्रक की मूल प्रति को अपने पास जमा कर, कार्बन प्रति को मूल प्रति से कट लाइन से मोड़ कर सावधानीपूर्वक अलग कर परीक्षार्थी को सौंपेंगे, जिसे परीक्षार्थी अपने साथ ले जायेंगे। परीक्षार्थी को उत्तर-पत्रक की कार्बन प्रति चयन प्रक्रिया पूर्ण होने तक सुरक्षित रखनी होगी एवं आयोग द्वारा माँगे जाने पर प्रस्तुत करनी होगी।

1. Which of the following is a basic assumption of Darcy's Law used in laboratory permeability tests ?

- (1) The flow is turbulent and uniform.
- (2) The flow is laminar and the soil is saturated.
- (3) The flow occurs through capillaries under suction only.
- (4) The soil is partially saturated and the flow is transient.
- (5) Question not attempted

2. The phase diagram given in the figure shows the change from initial state to final state due to consolidation. H is the depth of clay layer undergoing consolidation; e_0 is initial void ratio; e_f is final void ratio; Δe is the change in void ratio.

Indicate which of the following expression gives the settlement of the clay layer.



(1) $H \cdot \log_{10} \left[\frac{\Delta e}{1 + e_0} \right]$

(2) $\log_{10} \left[\frac{H \cdot \Delta e}{1 + e_0} \right]$

(3) $\frac{\Delta e}{1 + e_0}$

(4) $\frac{H \cdot \Delta e}{1 + e_0}$

(5) Question not attempted

3. In a sieve analysis of a soil sample, the effective size corresponding to particles that are 10% finer is found to be 0.6 mm, the particle size corresponding to 30% finer is 1.2 mm, and the particle size corresponding to 60% finer is 3.0 mm. What is the coefficient of curvature of the soil ?

- (1) 0.8
- (2) 1.2
- (3) 2.0
- (4) 3.6
- (5) Question not attempted

4. A soil sample has a Liquid Limit (LL) of 60%, a Plastic Limit (PL) of 30%, with 90% of the particles passing through the 75-micron IS sieve and containing 10% sand. Based on IS 1498 : 1970, what is the most appropriate classification for this soil ?

- (1) CL
- (2) CH
- (3) CH-MH
- (4) MH
- (5) Question not attempted

5. The dry unit weight of a sandy soil in its natural condition is 16 kN/m^3 . The minimum and maximum dry unit weights of the same soil are found to be 12 kN/m^3 and 20 kN/m^3 , respectively, what is the Density Index of the soil ?

- (1) 58.5%
- (2) 62.5%
- (3) 72.5%
- (4) 80.5%
- (5) Question not attempted

6. A soil deposit has three distinct layers stacked vertically. The top layer is 2 metres thick with a permeability of 4 m/day, the middle layer is 1 metre thick with a permeability of 2 m/day, and the bottom layer is 1 metre thick with a permeability of 4 m/day. What is the average permeability of the entire deposit for water flowing normal to bedding planes ?

- (1) 2.5 m/day
- (2) 3.2 m/day
- (3) 4.0 m/day
- (4) 5.0 m/day
- (5) Question not attempted

7. A retaining wall retains a sand stratum with $\phi = 30^\circ$ up to its top. If a uniform surcharge of 15 kN/m^2 is subsequently put on the sand strata, then the increase in the lateral earth pressure intensity on the retaining wall will be
- (1) 1.5 kN/m^2 (2) 5.0 kN/m^2
 (3) 3.0 kN/m^2 (4) 2.5 kN/m^2
 (5) Question not attempted

8. If a cantilever beam of length L carries a uniformly distributed load w only over a length 'a' from the fixed end, the expression for deflection at the free end is :
 (where E is modulus of elasticity and I is moment of inertia)

(1) $\frac{wa^4}{8EI} + \frac{wa^3}{6EI} (L - a)$

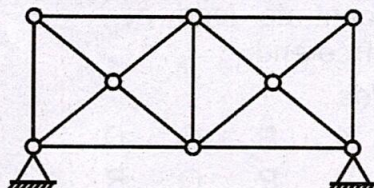
(2) $\frac{wL^4}{8EI}$

(3) $\frac{wa^4}{6EI} + \frac{wa^3}{8EI} (L - a)$

(4) $\frac{wa^4}{4EI}$

- (5) Question not attempted

9. Degree of static indeterminacy of a pin jointed plane frame, shown in Fig. is



(1) 2 (2) 3

(3) 4 (4) 6

- (5) Question not attempted

10. In the analysis of framed structures, let n denote the number of members and j denote the number of joints. A frame is said to be redundant when :

(1) $n < 2j - 3$

(2) $n = 2j - 3$

(3) $n > 2j - 3$

- (4) The geometry is unstable irrespective of n and j .

- (5) Question not attempted

11. A beam of triangular cross-section is used with base horizontal. The intensity of maximum shear stress will occur at which location along the depth ?

(1) Three eighth of the depth from top

(2) Half the depth from top

(3) Two third of the depth from top

(4) Three fourth of the depth from top

- (5) Question not attempted

12. The shear centre of a channel section placed with its flanges horizontal and its web vertical, lies _____.

(1) Inside the section on centroid of the channel section

(2) Inside the section on web of the channel section

(3) Outside the section above the neutral axis of the channel section

(4) Outside the section on the neutral axis of the channel section

- (5) Question not attempted

13. Which of the following statements about a Bending Moment Diagram (BMD) are true ?

- A. The BMD shows the variation of bending moment along the length of a beam.
- B. For a uniformly distributed load, the BMD is a parabolic curve.
- C. The bending moment changes suddenly at the location of a vertical point load.
- D. The point where bending moment is zero after changing its sign is called the point of contra-flexure.

- (1) A, B and D only
- (2) A, B, C and D
- (3) A and D only
- (4) B, C and D only
- (5) Question not attempted

14. If a simply supported beam AB of length L is subjected to a uniformly varying load throughout its length, the intensity of load is zero at the end A, then rises linearly to w KN/m at the centre of beam and further reduces linearly to zero at the end B of the beam. The shear force at the support A of the simply supported beam will be equal to _____.

- (1) zero
- (2) $\frac{wL}{4}$
- (3) $\frac{wL}{2}$
- (4) wL

(5) Question not attempted

15. A cantilever beam is subjected to a vertically downward point load W at the centre of its span L . The flexural rigidity of the beam is EI where E is Young's modulus of elasticity and I is moment of inertia of the beam. The vertical deflection at the free end of the beam will be equal to _____.

- (1) $\frac{WL^3}{3EI}$
- (2) $\frac{WL^3}{48EI}$
- (3) $\frac{5WL^3}{384EI}$
- (4) $\frac{5WL^3}{48EI}$
- (5) Question not attempted

16. Match List-I (Type and position of load on cantilever) with List-II (Shape of bending moment diagram for cantilever) and select the correct answer using the codes given below the lists :

List-I

List-II

- | | |
|--|-------------------|
| A. Subjected to bending moment at the free end of cantilever. | P. Triangle |
| B. Cantilever carrying uniformly distributed load over the whole length. | Q. Cubic parabola |
| C. Cantilever carrying linearly varying load from zero at its free end and maximum at the fixed end. | R. Parabola |
| D. Cantilever carrying concentrate load at the free end. | S. Rectangle |

Codes :

- | | A | B | C | D |
|-----|---|---|---|---|
| (1) | S | P | Q | R |
| (2) | S | R | Q | P |
| (3) | R | S | P | Q |
| (4) | R | S | Q | P |

(5) Question not attempted

17. A simply supported beam of span L carries a uniformly varying load from zero at end A to w per unit length at end B. The shear force at support A is :

- (1) $\frac{wL}{2}$ (2) $\frac{wL}{3}$
 (3) $\frac{wL}{6}$ (4) $\frac{2wL}{3}$
 (5) Question not attempted

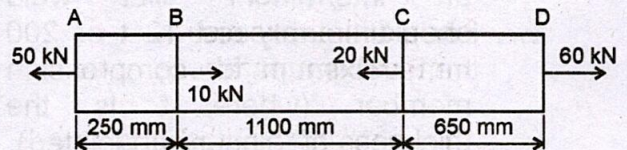
18. A steel bar 2 m long is fixed between two supports. If the temperature of the bar is raised by 20°C , find the stress in the bar in MPa if the supports are rigid. The co-efficient of thermal expansion of the material of bar is $12 \times 10^{-6}/^\circ\text{C}$ and Young's modulus of elasticity of the material of bar is 200 GPa.

- (1) 120 (Tensile)
 (2) 48 (Tensile)
 (3) 120 (Compressive)
 (4) 48 (Compressive)
 (5) Question not attempted

19. If a cylindrical rod is subjected to a uniform axial tensile stress within the elastic limit, the lateral strain will be :

- (1) Equal in magnitude and sign to longitudinal strain.
 (2) Equal in magnitude but opposite in sign to longitudinal strain multiplied by μ .
 (3) Equal in magnitude but opposite in sign to longitudinal strain divided by μ .
 (4) Zero.
 (5) Question not attempted

20. A bar of total length 2 m and uniform cross section 300 mm^2 is subjected to loads as shown in Figure below. If the value of modulus of elasticity of the material of bar is 200 GPa, the maximum stress in the bar will be equal to _____.



- (1) 133.33 N/mm^2
 (2) 166.67 N/mm^2
 (3) 200.00 N/mm^2
 (4) 233.33 N/mm^2
 (5) Question not attempted

21. A uniform, slender cylindrical rod is made of a homogeneous and isotropic material. The rod rests on a frictionless surface. The rod is heated uniformly. If the radial and longitudinal thermal stresses are represented by σ_r and σ_z respectively, then

- (1) $\sigma_r = 0, \sigma_z = 0$ (2) $\sigma_r \neq 0, \sigma_z = 0$
 (3) $\sigma_r = 0, \sigma_z \neq 0$ (4) $\sigma_r \neq 0, \sigma_z \neq 0$
 (5) Question not attempted

22. A bronze alloy specimen has a modulus of elasticity of $1.20 \times 10^5 \text{ N/mm}^2$ and Poisson's ratio of 0.3. The bulk modulus of the specimen will be equal to _____.

- (1) $0.57 \times 10^5 \text{ N/mm}^2$
 (2) $1.0 \times 10^5 \text{ N/mm}^2$
 (3) $1.5 \times 10^5 \text{ N/mm}^2$
 (4) $0.46 \times 10^5 \text{ N/mm}^2$
 (5) Question not attempted

23. Consider the following with regards to intermittent fillet welds :

- At the ends, the longitudinal intermittent fillet weld should be less than the width of member.
- The clear spacing between an intermittent fillet weld should not exceed $12t$ or 200 mm maximum for compression member (where t is the thickness of thinner part jointed).
- The minimum effective length of four times the size of weld with a minimum of 40 mm, except for plate girder.

- Only a and b are correct.
- Only b and c are correct.
- Only a and c are correct.
- All a, b and c are correct.
- Question not attempted

24. A frame has an indeterminacy of 2 and the numbers of possible plastic hinges are 3. The collapse will be

- Partial
- Complete
- Over complete
- Cannot be ascertained
- Question not attempted

25. According to IS 800 : 2007, what is the maximum permitted slenderness ratio for a member subjected to compression forces only due to wind or earthquake actions, provided its deformation does not adversely affect stresses in any part of the structure ?

- 180
- 250
- 300
- 400
- Question not attempted

26. According to IS 800 : 2007, the design strength of a tension member under axial load shall be the lowest of which three failure modes ?

- Rupture of weld, bearing of bolt, gross yielding.
- Yielding of gross section, rupture of critical section and block shear.
- Gross section buckling, net section tearing, bolt hole elongation.
- Tearing of weld, rupture of flange, shear lag.
- Question not attempted

27. Pick out the incorrect statement :

- The stiff bearing length is that length which cannot deform appreciably in bending.
- Bearing stiffeners are used to transfer concentrated loads on the girder and heavy reactions at supports to the full depth of the web.
- Intermediate transverse stiffeners are also called vertical stiffeners.
- The first longitudinal stiffener in a plate girder is provided at $0.5d$ from compression flange.
- Question not attempted

28. In plastic design of an I-section beam, if the permissible stress is taken as $\sigma = 0.5 f_y$ and the shape factor is $f = 1.2$, what is the typical value of the load factor used ?

- 1.60
- 2.0
- 2.40
- 1.80
- Question not attempted

29. In case of low shear force, the design bending strength determined by $\beta_b Z_p f_y / \gamma_{m0}$ is limited below $1.2 Z_e f_y / \gamma_{m0}$ for simply supported beams to ensure :

(Notations as per IS 800 : 2007.)

- A. That onset of plasticity under unfactored loads is prevented.
- B. That yield does not occur at working loads.
- C. That the lateral-torsional buckling is avoided.

Of the above

- (1) Only A is correct.
- (2) A and B are correct.
- (3) Only C is correct.
- (4) A and C are correct.
- (5) Question not attempted



30. The kinematic theorem of plastic analysis satisfies which of the following conditions ?

- (1) Equilibrium condition only.
- (2) Equilibrium condition and continuity condition.
- (3) Yield condition and Equilibrium condition.
- (4) Continuity condition and yield condition.
- (5) Question not attempted

31. According to IS 800 : 2007, what is the minimum size of a single-run fillet weld when the thicker part being joined is exactly 10 mm thick ? (Assume the thickness of thinner part is 5 mm.)

- (1) 3 mm (2) 4 mm
- (3) 5 mm (4) 6 mm
- (5) Question not attempted

32. For gantry girder carrying manually operated overhead cranes, the vertical forces transferred to the rails, are increased by

- (1) 25% of maximum static wheel load.
- (2) 10% of maximum static wheel load.
- (3) 5% of the static wheel load.
- (4) 5% of the weight of the crab and weight lifted on the crane.
- (5) Question not attempted

33. A singly reinforced beam of width 300 mm and total depth 600 mm has an effective cover of 50 mm on all sides. Concrete grade is M 30 and steel grade is Fe 500. The area of tensile reinforcement required in the beam for balanced section design, as per IS 456 : 2000 is equal to

- (1) 1885 mm² (2) 1967 mm²
- (3) 2056 mm² (4) 2145 mm²
- (5) Question not attempted

34. A doubly reinforced beam of size 25 cm by 50 cm deep if it is reinforced with Fe 500 grade steel 2-16 mm dia bars in compression zone and 4-20 mm dia bars in tension zone, each at an effective cover of 40 mm. The effective depth of the beam is

- (1) 400 mm (2) 420 mm
- (3) 460 mm (4) 440 mm
- (5) Question not attempted

35. A singly reinforced rectangular beam of width $b = 250$ mm, effective depth $d = 500$ mm is made of M20 concrete and Fe 415 steel.


If the section is balanced, the limiting moment of resistance $M_{u, \text{lim}}$ is

- (1) $M_{u, \text{lim}} = 110$ KNm
- (2) $M_{u, \text{lim}} = 238$ KNm
- (3) $M_{u, \text{lim}} = 170.8$ KNm
- (4) $M_{u, \text{lim}} = 172.9$ KNm
- (5) Question not attempted

36. The minimum grade of concrete required as per IS 456 : 2000 for extreme exposure condition of a reinforced concrete member, with normal weight aggregates of 20 mm, nominal maximum size, is

- (1) M 40 (2) M 35
- (3) M 45 (4) M 50
- (5) Question not attempted

37. The minimum nominal cover required as per IS 456 : 2000 for moderate exposure condition of a reinforced concrete member, is _____.

- 
- (1) 50 mm (2) 30 mm
 - (3) 25 mm (4) 35 mm
 - (5) Question not attempted

38. According to IS 456 : 2000, the deflection of an RC floor beam (including effects of temperature, creep and shrinkage) after the erection of partitions and finishes, for an effective span of 5.25 m, should not exceed :

- (1) 12 mm (2) 15 mm
- (3) 20 mm (4) 25 mm
- (5) Question not attempted

39. If the size of the column is 250 x 300 mm and effective depth of footing is 400 mm, the perimeter of critical section for two way shear is

- (1) 1500 mm (2) 1800 mm
- (3) 2700 mm (4) 3300 mm
- (5) Question not attempted

40. According to IS 456 : 2000, which of the following statements regarding the design of shear reinforcement is correct ? (Where τ_v and τ_c are nominal shear stress and design shear strength of the concrete, respectively).

- (1) Bent-up bars alone can be provided to carry total shear if τ_v exceeds τ_c .
- (2) Shear reinforcement shall only be in the form of vertical stirrups.
- (3) Contribution of bent-up bars shall not exceed 50% of total shear reinforcement.
- (4) Shear reinforcement is not required if nominal shear stress exceeds design shear strength.
- (5) Question not attempted

41. Calculate the development length L_d for a 12 mm diameter bar subjected to a design stress of 400 N/mm², if the design bond stress τ_{bd} is 2.0 N/mm².

- (1) 400 mm (2) 600 mm
- (3) 800 mm (4) 1200 mm
- (5) Question not attempted

42. A reinforced concrete beam has an effective depth of 420 mm. As per IS 456 : 2000, what is the maximum permissible spacing of vertical shear stirrups along the beam ?

- (1) 250 mm (2) 300 mm
- (3) 315 mm (4) 350 mm
- (5) Question not attempted

43. For M 30 grade of concrete, the design bond stress for plain bars in tension as per IS 456 : 2000 is

- (1) 1.7 N/mm² (2) 1.5 N/mm²
- (3) 1.4 N/mm² (4) 1.2 N/mm²
- (5) Question not attempted

44. As per IS 456 : 2000, what should be the minimum overall depth of a short two-way continuous slab of span 3.2 m, reinforced with high strength deformed bars of grade Fe415 and subjected to a live load 2.5 kN/m^2 , to satisfy the deflection control criterion ?

- (1) 60 mm (2) 80 mm
- (3) 100 mm (4) 120 mm
- (5) Question not attempted

45. Read the statements carefully and choose the correct option from the choices given.

Statement-I : As per IS 456 : 2000, all columns shall be designed for a minimum eccentricity of $\frac{L}{500} + \frac{D}{20}$, subject to a minimum of 30 mm.

Statement-II : For columns under biaxial bending, it is sufficient to ensure that the eccentricity exceeds the minimum value about one axis at a time.

- (1) Both Statement-I and Statement-II are true, and Statement-II is the correct explanation of Statement-I.
- (2) Both Statement-I and Statement-II are true, but Statement-II is not the correct explanation of Statement-I.
- (3) Statement-I is true, but Statement-II is false.
- (4) Statement-I is false, but Statement-II is true.
- (5) Question not attempted

46. According to IS 3370 (Part 2) : 2021, for ground-supported tanks with length $\geq 22 \text{ m}$ using Fe 415 steel, the minimum reinforcement in each of two directions within each surface zone should be :

- (1) 0.24% (2) 0.36%
- (3) 0.28% (4) 0.42%
- (5) Question not attempted

47. For reinforced concrete water-retaining structures with capacity more than 50 m^3 , the minimum grade of concrete and maximum free water-cementitious ratio shall be :

- (1) M20 and 0.50 (2) M25 and 0.45
- (3) M30 and 0.45 (4) M40 and 0.40
- (5) Question not attempted

48. The fluid for which shear stress is always zero regardless of the motion of the fluid is known as _____.

- (1) Elastic solid
- (2) Thixotropic
- (3) Non-Newtonian fluid
- (4) Ideal fluid
- (5) Question not attempted

49. A vertical rectangular plate 2 m x 3 m is immersed in a static water with its 3 m side vertical and its top edge at the free surface. The depth of the centre of pressure below the free surface is :

- (1) 1.25 m (2) 1.50 m
- (3) 2.00 m (4) 2.25 m
- (5) Question not attempted

50. Read the statements carefully and choose the correct option from the choices given.

Statement-I : Euler's equation along a streamline can be derived from Newton's second law of motion applied to a fluid element.

Statement-II : Bernoulli's equation is obtained by integrating Euler's equation along a streamline, considering compressible and viscous flow.

- (1) Both Statement-I and Statement-II are true, and Statement-II is the correct explanation of Statement-I.
- (2) Both Statement-I and Statement-II are true, but Statement-II is not the correct explanation of Statement-I.
- (3) Statement-I is true, but Statement-II is false.
- (4) Statement-I is false, but Statement-II is true.
- (5) Question not attempted

51. A partially submerged orifice behaves as :

- (1) A sharp-edged orifice throughout its depth.
- (2) A free orifice in the lower portion and a drowned orifice in the upper portion.
- (3) A free orifice in the upper portion and a submerged orifice in the lower portion.
- (4) A bell-mouthed orifice throughout its depth.
- (5) Question not attempted

52. Which of the following surface profiles occur when the flow depth lies between normal depth and critical depth on a steep slope ?

- (1) S_1 profile (2) S_2 profile
- (3) S_3 profile (4) H_4 profile
- (5) Question not attempted

53. In plain Couette laminar flow of fluid between two parallel plates, if one plate moves with velocity (V) and the other remains stationary, the velocity distribution (v) is given by :

(where B = distance between plates and y = distance from lower plate boundary and v is the velocity in transverse direction.)

- (1) $v = \frac{V}{B} y$ (2) $v = \frac{V}{2B^2} y^2$
- (3) $v = V(1 - y/B)$ (4) $v = \frac{V}{B^2} y(B - y)$
- (5) Question not attempted

54. For a solid sphere of diameter D moving with velocity V in a fluid of density ρ and viscosity μ , the drag force F_D can be expressed in terms of the drag co-efficient C_D as :

$$F_D = C_D A \frac{\rho V^2}{2}$$

Where A is the projected area of the sphere and C_D is the drag co-efficient. Based on Stokes' law, for a sphere moving in an infinite fluid with Reynolds number (Re) < 0.2 , the correct expression for C_D is :

- (1) $C_D = \frac{16}{Re}$ (2) $C_D = \frac{24}{Re}$
- (3) $C_D = \frac{48}{Re}$ (4) $C_D = \frac{12}{Re}$
- (5) Question not attempted

55. If a fluid flow phenomenon involves Inertia, Gravity and Elasticity forces, then the dimensionless numbers to be formed together are :

- (1) Reynolds number and Mach number
- (2) Weber number and Reynolds number
- (3) Mach number and Froude number
- (4) Euler number and Mach number
- (5) Question not attempted

56. Water flows through a long pipe having a length L , diameter D with a velocity V . The friction factor for the pipe is f . The head loss through the pipe due to friction is h . If the length of that pipe is doubled, diameter of that pipe is halved and velocity of flow through the pipe is also halved, the head loss through the pipe due to friction will be equal to _____.

- (1) $h/4$ (2) $h/2$
- (3) h (4) $4h$
- (5) Question not attempted

57. The peak of a flood hydrograph due to a 4 hour duration isolated storm in a catchment is $300 \text{ m}^3/\text{sec}$. The total depth of rainfall is 6.2 cm. Assuming an average infiltration loss of 0.3 cm/hour and a constant base flow of $50 \text{ m}^3/\text{sec}$, the peak of the 4-h unit hydrograph, of this catchment can be calculated as _____ m^3/sec .

- (1) 70 (2) 60
- (3) 50 (4) 40
- (5) Question not attempted

58. As per water quality standards, the minimum acceptable limit of free residual chlorine in public water on a regular day at the point of supply should be :

- (1) 0.1 mg/l (2) 0.5 mg/l
- (3) 0.2 mg/l (4) 1.0 mg/l
- (5) Question not attempted

59. Which mechanism is primarily responsible for particle removal in rapid sand filtration ?

- (1) Straining and adsorption
- (2) Chemical precipitation
- (3) Electrostatic attraction
- (4) Biological degradation
- (5) Question not attempted

60. Which of the following traps is generally provided at the junction of a house sewer and a municipal sewer to prevent the entry of foul gases from the municipal sewer into the house drainage system ?

- (1) P-trap (2) S-trap
- (3) Gully trap (4) Intercepting trap
- (5) Question not attempted

61. If 3 ml of raw sewage has been diluted to 300 ml and the D.O. concentration of the diluted sample at the beginning of the BOD test was 8 mg/l, and 5 mg/l after 5-day incubation at 20°C ; find the BOD of raw sewage.

- (1) 100 mg/l (2) 300 mg/l
- (3) 200 mg/l (4) 250 mg/l
- (5) Question not attempted

62. In the biochemical reaction representing the BOD test,
 $\text{C}_x\text{H}_y\text{O}_z + \text{O}_2 \rightarrow \text{CO}_2 + \text{H}_2\text{O} + \text{energy}$
 The role of molecular oxygen in the process is to act as the :

- (1) Electron donor
- (2) Electron acceptor
- (3) Catalyst
- (4) pH buffer
- (5) Question not attempted

63. Lower F/M value in a conventional activated sludge treatment plant will mean :

- (1) Lower BOD removal
- (2) Higher BOD removal
- (3) No effect on BOD removal
- (4) No longer sludge age
- (5) Question not attempted

64. Sequencing Batch Reactor (SBR) is a type of :

- (1) Continuous flow reactor
- (2) Plug flow reactor
- (3) Fixed film reactor
- (4) Time-controlled fill and draw type reactor
- (5) Question not attempted

65. Which of the following statements accurately describes the metabolic activity in a facultative region of stabilization ponds ?

- (1) Only aerobic bacteria are active throughout the pond volume.
- (2) Anaerobic bacteria dominate in the upper layers of the pond.
- (3) Bacteria in the middle layer switch metabolism based on loading conditions.
- (4) Organic acids are converted to methane by aerobic bacteria.
- (5) Question not attempted

66. Which types of bacterial forms are present in larger numbers in trickling filters compared to the activated sludge process ?

- (1) Spore-forming bacteria
- (2) Rod-shaped bacteria
- (3) Filamentous forms and stalked bacteria
- (4) Anaerobic bacteria
- (5) Question not attempted

67. As per Environment (Protection) Rules, 1986, what is the maximum permissible limit of COD in effluents discharged into inland surface waters ?

- (1) 100 mg/l (2) 200 mg/l
- (3) 250 mg/l (4) 350 mg/l
- (5) Question not attempted

68. A two lane road in plain terrain with design speed of 60 kmph has horizontal curve of radius 180 m. The rate of super elevation to be adopted for the horizontal curve, taking three fourth of design speed, as per IRC : 86-2018, is

- (1) 0.157 (2) 0.089
- (3) 0.081 (4) 0.070
- (5) Question not attempted

69. In cement concrete pavements, tie bars are installed in :

- (1) Expansion joints
- (2) Contraction joints
- (3) Warping joints
- (4) Longitudinal joints
- (5) Question not attempted

70. The 85th percentile speed, obtained from spot speed studies, is primarily used for :

- (1) Calculating traffic signal cycle speed
- (2) Determining safe speed limits
- (3) Estimating vehicle occupancy
- (4) Calculating traffic volume
- (5) Question not attempted

71. What is the standard shape and colour scheme of cautionary traffic signs ?

- (1) Circular with blue border and black symbols.
- (2) Rectangular with green background and white symbols.
- (3) Triangular with red border and black symbols on white background.
- (4) Octagonal with white background and red symbols.
- (5) Question not attempted

72. In a mountainous terrain, a ruling gradient of 5% is used for a road. If horizontal curve of 75 m radius is required to be provided on this stretch, what is the grade compensation on this curve ?

- (1) 4% (2) 5%
- (3) 3% (4) 4.5%
- (5) Question not attempted

73. As per IRC : 37-2018, which mechanistic parameter is critical for controlling fatigue cracking in Cement Treated Base (CTB) layer during pavement design ?

- (1) Vertical compressive strain at top of CTB.
- (2) Modulus of subgrade reaction at bottom of CTB.
- (3) Horizontal tensile stress and strain at bottom of CTB layer.
- (4) Poisson's ratio variation in CTB with temperature.
- (5) Question not attempted

74. Which of the following kerb parking types allows the maximum number of vehicles to be parked per unit length of the kerb ?

- (1) Parallel parking
- (2) 30° angle parking
- (3) 45° angle parking
- (4) 90° angle parking
- (5) Question not attempted

75. Which type of pavement overlay needs to be designed by Benkelman beam deflection method ?

- (1) Rigid overlay on rigid pavement
- (2) Flexible overlay on rigid pavement
- (3) Rigid overlay on flexible pavement
- (4) Flexible overlay on Flexible pavement
- (5) Question not attempted

76. As per the provisions of IRC : 86-2018, the recommended carriage-way width for 4 lane urban road with raised kerbs, is given as _____.

- (1) 14 m (2) 14.5 m
- (3) 15 m (4) 15.5 m
- (5) Question not attempted

77. In a heavy rainfall area, a two-lane State Highway with bituminous concrete surface has a pavement width of 7.0 m. As per IRC recommendations, if the cross slope is 1 in 50 and straight line camber is used, what will be the rise of crown with respect to the edges ?

- (1) 0.035 m (2) 0.058 m
- (3) 0.070 m (4) 0.033 m
- (5) Question not attempted

78. As per IRC:86-2018, the minimum vertical clearance to be provided for underpasses for vehicles on urban roads is :

- (1) 4.5 m (2) 5.0 m
- (3) 5.5 m (4) 6.0 m
- (5) Question not attempted

79. As per the provisions of IRC:5-2015, for a single lane high level bridge constructed for the use of road traffic only, the width of carriageway shall not be less than _____.

- (1) 3.75 m (2) 4.25 m
- (3) 5.0 m (4) 5.5 m
- (5) Question not attempted

80. What is the critical rut depth used as the failure criterion for subgrade rutting in flexible pavement design ?

- (1) 10 mm (2) 15 mm
- (3) 20 mm (4) 5 mm
- (5) Question not attempted

81. As per IRC:52-2019, in terrain classification, which type is identified when the general cross slope of the country across the alignment is less than 10% ?

- (1) Plain terrain
- (2) Rolling terrain
- (3) Mountainous terrain
- (4) Steep terrain
- (5) Question not attempted

82. As per the provisions of IRC:5-2015, a bridge can be classified as a major bridge, when its total length is more than _____.

- (1) 40 m (2) 50 m
- (3) 60 m (4) 30 m
- (5) Question not attempted

83. Which principle of building planning focuses on the strategic placement of doors and windows to either highlight desirable views or conceal undesirable ones ?
(1) Aspect (2) Privacy
(3) Prospect (4) Circulation
(5) Question not attempted
84. In which bond, the bricks are laid at an angle of 45° from the centre in both the directions ?
(1) Flemish bond
(2) English bond
(3) Herring-bone bond
(4) Header bond
(5) Question not attempted
85. Which structural component in a close couple roof truss is primarily responsible for resisting tensile forces ?
(1) Principal rafter
(2) Tie beam
(3) Strut
(4) Purlin
(5) Question not attempted
86. As per Indian Standard for brickworks, when the burnt clay bricks are tested for compressive strength, the uniform loading rate per minute shall be
(1) 8 N/mm^2 (2) 10 N/mm^2
(3) 14 N/mm^2 (4) 18 N/mm^2
(5) Question not attempted
87. Which natural defect in timber involves a longitudinal separation of wood between annual rings, often reducing the shear strength of the wood ?
(1) Knot (2) Split
(3) Shake (4) Warp
(5) Question not attempted

88. Which characteristic is used to understand the aggregate-Bitumen adhesion properties in presence of water ?
(1) Softening point
(2) Ductility
(3) Stripping value
(4) Flash point
(5) Question not attempted
89. Which type of window projects outward from the wall surface and improves both light intake and aesthetics ?
(1) Dormer window
(2) Bay window
(3) Casement window
(4) Clerestory window
(5) Question not attempted
90. As per IS 1489 (Part 1) : 2015, for fly ash based Portland pozzolana cement, the maximum value of soundness permitted, when measured by Le Chatelier method is
(1) 8 mm (2) 10 mm
(3) 12 mm (4) 15 mm
(5) Question not attempted
91. The coordinate of a point from total station is determined using
(1) Chain survey
(2) Horizontal angle, vertical angle and slope distance
(3) Triangulation
(4) Trigonometric levelling
(5) Question not attempted
92. In contour representation, a vertical cliff and an overhanging cliff can be distinguished based on :
(1) Closely spaced contours for both, with figures inside indicating the cliff face.
(2) Coinciding contours for vertical cliff and intersecting contours for overhanging cliff.
(3) Uniformly spaced contours showing rapid elevation change.
(4) Disjoint contours that taper into each other indicating steep drops.
(5) Question not attempted

93. In trigonometric levelling, the combined correction to the observed vertical angle for curvature and refraction (in angular measure) is given by :

Where : D is the horizontal distance between two stations ; R is the radius of the Earth ; m is the co-efficient of refraction.

(1) $\frac{D}{R \sin 1''} (1 + 2m)$

(2) $\frac{D}{2R \sin 1''} (1 - 2m)$

(3) $\frac{2D}{R \sin 1''} (1 - m)$

(4) $\frac{D^2}{2R} (1 - m)$

(5) Question not attempted

94. The method of least squares assumes the discrepant observations to be :

- (1) Negative cumulative errors
- (2) Positive cumulative errors
- (3) Accidental errors
- (4) Systematic errors
- (5) Question not attempted

95. In context of geographic information system, the line - in - polygon method is characteristic of

- (1) Raster overlay
- (2) Vector overlay
- (3) Buffer operation
- (4) Intersecting operation
- (5) Question not attempted

96. At a point in a soil mass, the total normal stress is 200 kN/m^2 , and the pore water pressure is 80 kN/m^2 . The effective shear strength parameters are : cohesion $c' = 16 \text{ kN/m}^2$ and angle of internal friction $\phi' = 45^\circ$. The shear strength of the soil at this point is :

- (1) 100 kN/m^2
- (2) 116 kN/m^2
- (3) 136 kN/m^2
- (4) 156 kN/m^2
- (5) Question not attempted

97. The change in the vertical stress in the soil mass estimated by Boussinesq's equation when Poisson's ratio of soil changes from 0.3 to 0.5 will be :

- (1) Reduction by 30%
- (2) Increase by 50%
- (3) Reduction by 20%
- (4) No change
- (5) Question not attempted

98. Which type of shear failure is characterized by a well-defined failure pattern, sudden slip, tilting of the foundation, and bulging of the ground surface adjacent to the footing ?

- (1) Local shear failure
- (2) General shear failure
- (3) Punching shear failure
- (4) Plastic yield failure
- (5) Question not attempted

99. A vertical cut is to be excavated in a saturated clay deposit with cohesion $c = 18 \text{ kN/m}^2$, unit weight $\gamma = 9 \text{ kN/m}^3$ and undrained friction angle $\phi = 0^\circ$. The theoretical maximum depth (in metres) to which the cut can be made without side collapse is :

- (1) 2
- (2) 4
- (3) 8
- (4) 12
- (5) Question not attempted

100. In case of one-dimensional consolidation of soil, if degree of consolidation needed and co-efficient of consolidation remain same but the condition of drainage in soil is changed from single drainage to double drainage, the time required for consolidation of soil will _____.

- (1) Increase to two times the initial value
- (2) Increase to four times the initial value
- (3) Decrease to half the initial value
- (4) Decrease to one fourth the initial value
- (5) Question not attempted

रफ कार्य के लिए स्थान / SPACE FOR ROUGH WORK

