प्रश्नपत्रिका क्रमक  
स्थापत्य अभियात्रिकी  
बप्पा -2 (होत्र) तास  

सूचना  

(1) सन्दर्भ प्रश्नपत्रिका क्रमक 100 अभियात्री मे प्रश्न प्राप्त आहेत. उपज्ञानीय प्रश्नांतर साहित्य सुनिश्चित करण्यापुरी या प्रश्नपत्रिका हे साहित्य सुनिश्चित करण्यापुरी या प्रश्न प्राप्त आहेत. त्यासाठी आपल्या साधने किंवा अन्य साधने म्हणून साहित्यपत्रों च्या वापराची अन्वेषण करावे. त्यासाठी अन्य काही विविध साधने प्राप्त करावे. 

(2) आपल्या प्रश्नपत्रिकेच्या  हा चौकोणांत  

विवरण करण्यासाठी चौकोणांत  

पत्रीका क्रमक  

(3) वर चौकोणेच्या प्रश्नपत्रिकेच्या क्रमकात सुचित उपज्ञानीयवर विशेष आपल्या उपज्ञानीयवर्त चौकोणांत सुचित चौकोणांत व निवर्तीत नकारात्मक. 

(4) या प्रश्नपत्रिकेची प्रश्न प्रसार 4 पार्टीं मध्ये सुचित चौकोणांत सुचित 1, 2, 3 अणूं 4 अणूं क्रमाने दिला आहे. त्याच्या चार व तीन अणूं क्रमांत उपज्ञानीय सूचीत उपज्ञानीयवर व उपज्ञानीयवर प्रश्नपत्रिकेच्या 4 पार्टीं मध्ये सुचित 1, 2, 3 अणूं 4 अणूं क्रमाने दिला आहे. 

(5) या प्रश्नपत्रिकेची प्रश्न प्रसार 4 पार्टीं मध्ये सुचित चौकोणांत सुचित 1, 2, 3 अणूं 4 अणूं क्रमाने दिला आहे. त्याच्या चार व तीन अणूं क्रमांत उपज्ञानीय सूचीत उपज्ञानीयवर व उपज्ञानीयवर प्रश्नपत्रिकेच्या 4 पार्टीं मध्ये सुचित 1, 2, 3 अणूं 4 अणूं क्रमाने दिला आहे. 

(6) उपज्ञानीय शर्तांच्या 4 पार्टीं मध्ये सुचित चौकोणांत सुचित 1, 2, 3 अणूं 4 अणूं क्रमाने दिला आहे. त्याच्या चार व तीन अणूं क्रमांत उपज्ञानीय सूचीत उपज्ञानीयवर व उपज्ञानीयवर प्रश्नपत्रिकेच्या 4 पार्टीं मध्ये सुचित 1, 2, 3 अणूं 4 अणूं क्रमाने दिला आहे. 

(7) प्रश्नपत्रिकेची प्रश्न प्रसार 4 पार्टीं मध्ये सुचित 1, 2, 3 अणूं 4 अणूं क्रमाने दिला आहे. त्याच्या चार व तीन अणूं क्रमांत उपज्ञानीय सूचीत उपज्ञानीयवर व उपज्ञानीयवर प्रश्नपत्रिकेच्या 4 पार्टीं मध्ये सुचित 1, 2, 3 अणूं 4 अणूं क्रमाने दिला आहे. 

तातकोट:  
हा प्रश्नपत्रिकेची आयोगाचे विविध केलेल्या वेळ संपूर्णत्य शीर्षकात हा प्रश्नपत्रिकेच्या आयोगाच्या माध्यमात असल तो  
परीक्षकांशी उपज्ञानाला पूर्वसंधारण वापरावया देविलेलं म्हटलं होतं. तर हा उपज्ञानाला पूर्वसंधारणाच्या समाप्तीत परीक्षकांशी उपज्ञानाला वापरावया देविलेलं म्हटलं होतं.
1. The rank of the following matrix is:

\[
\begin{bmatrix}
1 & 2 & 3 \\
1 & 4 & 2 \\
2 & 6 & 5 \\
\end{bmatrix}
\]

(1) 1  (2) 2  (3) 3  (4) 4

2. Investigate the values of \( \lambda \) and \( \mu \) so that the following equations have an infinite number of solutions:

\[2x + 3y + 5z = 9\]
\[7x + 3y - 2z = 8\]
\[2x + 3y + \lambda z = \mu.\]

(1) \( \lambda = 5, \mu = 9 \)  (2) \( \lambda = 5, \mu = 0 \)  (3) \( \lambda = 0, \mu = 9 \)  (4) \( \lambda = 0, \mu = 0 \)

3. Laplace transform of \( e^{at} \cos(bt) \) if \( S > a \) is:

(1) \( \frac{b}{(S - a)^2 + b^2} \)  (2) \( \frac{S - a}{(S - a)^2 + b^2} \)

(3) \( \frac{S - a}{(S - a)^2 - b^2} \)  (4) \( \frac{b}{(S - a)^2 - b^2} \)

4. The differential equation of \( xy = Ae^x + Be^{-x} \) is:

(1) \( x \frac{d^2y}{dx^2} - 2 \frac{dy}{dx} + xy = 0 \)  (2) \( x \frac{d^2y}{dx^2} - 2 \frac{dy}{dx} - xy = 0 \)

(3) \( x \frac{d^2y}{dx^2} + 2 \frac{dy}{dx} + xy = 0 \)  (4) \( x \frac{d^2y}{dx^2} + 2 \frac{dy}{dx} - xy = 0 \)

5. Evaluate upto three digits using Trapezoidal rule taking \( h = \frac{1}{4} \)

\[ I = \int_0^1 \frac{dx}{1 + x^2} \]

(1) 0.783  (2) 0.875  (3) 0.578  (4) 0.857

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P.T.O.
6. The gradient of \( f(x, y, z) = x^3 - xy^2 - z \) at \( P_0(1, 1, 0) \) is:

(1) \( 2i + 2j + k \)  
(2) \( 2i - 2j - k \)  
(3) \( 2i + 2j - k \)  
(4) \( -2i - 2j + k \)

7. Match the List - I (functions) with List - II (Laplace transforms) and select the correct answer:

<table>
<thead>
<tr>
<th>List - I</th>
<th>List - II</th>
</tr>
</thead>
<tbody>
<tr>
<td>(a) ( \int f(t) , dt )</td>
<td>(i) ( \frac{a}{s^2 - a^2} )</td>
</tr>
<tr>
<td>(b) Sinhat</td>
<td>(ii) ( \frac{e^{-as}}{S} )</td>
</tr>
<tr>
<td>(c) ( U(t-a) )</td>
<td>(iii) ( \frac{F(S)}{S} )</td>
</tr>
<tr>
<td>(d) ( \delta(t-a) )</td>
<td>(iv) ( e^{-as} )</td>
</tr>
</tbody>
</table>

**Answer Options:**

<table>
<thead>
<tr>
<th>(a)</th>
<th>(b)</th>
<th>(c)</th>
<th>(d)</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1)</td>
<td>(iv)</td>
<td>(i)</td>
<td>(iii)</td>
</tr>
<tr>
<td>(2)</td>
<td>(iii)</td>
<td>(i)</td>
<td>(iv)</td>
</tr>
<tr>
<td>(3)</td>
<td>(i)</td>
<td>(iii)</td>
<td>(iv)</td>
</tr>
<tr>
<td>(4)</td>
<td>(ii)</td>
<td>(iv)</td>
<td>(iii)</td>
</tr>
</tbody>
</table>

8. Two non-zero vectors \( \vec{a} \) and \( \vec{b} \) are parallel if:

(1) \( \vec{a} \times \vec{b} = \vec{0} \)  
(2) \( |\vec{a} \times \vec{b}| = 1 \)  
(3) \( \vec{a} \cdot \vec{b} = 0 \)  
(4) \( |\vec{A}| = |\vec{B}| \)

9. A simply supported beam of span 'l' is carrying a uniformly distributed load of \( \omega \) per unit run over the whole span. The magnitude of deflection at mid-span is

\( EI - \text{flexural rigidity} \)

(1) \( 5 \omega l^4 / 384 \, EI \)  
(2) \( \omega l^3 / 48 \, EI \)  
(3) \( \omega l^3 / 3 \, EI \)  
(4) \( \omega l^4 / 8 \, EI \)

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10. Web of ISMB 300 (secondary beam) is transferring reaction to web of another ISMB 300 (main beam). Which of the following connections is most suitable? Consider the top flange of beams are maintained at the same level.

(1) Bracket plate connection  (2) Stiffened seat connection
(3) Unstiffened seat connection  (4) Frame connection

11. Two shafts ‘A’ and ‘B’ are used to transmit power. Shaft A is solid with diameter ‘d’, whereas shaft ‘B’ is hollow with external diameter ‘d’ and internal diameter ‘\(d/2\)’. Material, length, maximum shear stresses and speed being the same, what is percentage reduction in power transmission if ‘A’ is replaced by ‘B’?

(1) No change in power transmission
(2) 50% reduction
(3) 6.25% reduction
(4) 93.75% reduction

12. Which of the following is/are true about a load balancing cable in a prestressed concrete beam?

(a) Bending moment due to working load is counteracted completely.
(b) Shear force due to working load is counteracted completely.
(c) Pressure line will pass from neutral axis throughout the span.
(d) Stresses will be uniform throughout the span and will be equal to direct axial compressive stresses.

(1) Only (a)  (2) Only (a) and (b)
(3) Only (c) and (d)  (4) All (a), (b), (c) and (d)

13. Web crippling in a steel beam, occurs due to:

(1) Column action of compressive flange
(2) Failure of web under concentrated load
(3) Failure of web under excessive B.M.
(4) Secondary bending moment

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P.T.O.
14. A cylindrical vessel whose ends are closed by means of rigid flange plates, is made of steel plate 3 mm thick. The internal length and diameter of vessel are 50 cm and 25 cm respectively. The longitudinal stress of 62.5 MN/m² and circumferential stress of 125 MN/m² is developed in the cylindrical shell due to internal fluid pressure. Taking Poisson’s ratio = 0.3 and E = 200 GN/m², the change in length of cylinder shall be:

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
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<tbody>
<tr>
<td>1</td>
<td>0.000531 mm</td>
</tr>
<tr>
<td>2</td>
<td>0.000125 mm</td>
</tr>
<tr>
<td>3</td>
<td>0.133 mm</td>
</tr>
<tr>
<td>4</td>
<td>0.0625 mm</td>
</tr>
</tbody>
</table>

15. For a plate girder with effective depth of 1500 mm, the connection of vertical stiffner to the web of plate girder, having 10 mm thickness of web and outstand width of stiffner of 50 mm are designed for:

<p>| | |</p>
<table>
<thead>
<tr>
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<tbody>
<tr>
<td>1</td>
<td>Shear force = 0.04 kN/mm</td>
</tr>
<tr>
<td>2</td>
<td>Shear force = 0.4 kN/mm</td>
</tr>
<tr>
<td>3</td>
<td>Bending moment = 0.04 kN-mm</td>
</tr>
<tr>
<td>4</td>
<td>Bending moment = 0.4 kN-mm</td>
</tr>
</tbody>
</table>

16. (a) Battens are designed to carry longitudinal shear
(b) Battens are designed to carry moment.
(c) Lacings are designed to carry axial tension.
(d) Lacings are designed to carry axial compression.
(e) Lacings are designed to carry moment.

Which of the above statements are correct?

<p>| | |</p>
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<thead>
<tr>
<th></th>
<th></th>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>(a), (b) and (c) only</td>
</tr>
<tr>
<td>2</td>
<td>(a), (b) and (e) only</td>
</tr>
<tr>
<td>3</td>
<td>(a), (b), (c) and (d) only</td>
</tr>
<tr>
<td>4</td>
<td>(b), (c) and (e) only</td>
</tr>
</tbody>
</table>

17. If all bolts are equal in diameter, which bolts are critical?

<p>| | |</p>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>(A) and (B) only</td>
</tr>
<tr>
<td>2</td>
<td>(A), (B), (C) and (D) all are equally critical</td>
</tr>
<tr>
<td>3</td>
<td>(A) and (D)</td>
</tr>
<tr>
<td>4</td>
<td>(B) and (C)</td>
</tr>
</tbody>
</table>

कङ्घ्या कामासाठी जागा /SPACE FOR ROUGH WORK
18. (a) Slender section
   (b) Semicom pact section
   (c) Compact section
   (d) Plastic section

   Correct match is:
   (a)  (b)  (c)  (d)
   (1)  (ii)  (iv)  (i)  (iii)
   (2)  (iv)  (iii) (i)  (ii)
   (3)  (i)  (ii)  (iii) (iv)
   (4)  (i)  (iv)  (i)  (iii)

19. A perfect pin jointed frame should satisfy the equation (where \( m \) = number of members and \( j \) = number of joints)

   (1) \( m = 2j - 4 \)  (2) \( m = 3j - 3 \)  (3) \( m = 3j - 2 \)  (4) \( m > 2j - 3 \)
20. Keeping all other parameters the same, the end condition of four different columns are as shown.

[Same height and cross-section]

Relation for buckling load will be

1. \( P_a = P_b = P_c = P_d \)
2. \( P_b > P_d > P_c > P_e \)
3. \( P_a > P_b > P_c > P_d \)
4. \( P_a > P_c > P_d > P_b \)

21. As per IS 456: 2000, the vertical deflection limits for a cantilever may generally be assumed to be satisfied provided the effective span to effective depth ratio is not greater than:

1. 7
2. 20
3. 26
4. 10/span

22. 

'D' is a weightless ring 'E' is a frictionless pulley. Calculate tension cable AB

1. \( 200 \sqrt{3} \text{ N} \)
2. \( 900 \sqrt{2} \text{ N} \)
3. \( 800 \text{ N} \)
4. \( 1800 \text{ N} \)
23. Determine force in member 'AB' of truss:

\[ 1000 \text{ N} \]
\[ 1.5 \text{ m} \]
\[ 1.5 \text{ m} \]
\[ 1.5 \text{ m} \]
\[ 1 \text{ m} \]
\[ 1 \text{ m} \]

(1) 666.67 N (T)  
(2) 1500 N (T)  
(3) \( 1000 \sqrt{2} \) N (T)  
(4) Zero

24. A symmetric I-section is used as a cantilever beam. It has to carry a point load at cantilever end in addition to its own wt. Which of the following statements are correct?

(a) Flexural tensile stresses will act at bottom fibre and flexural compressive stresses will act at top fibre of the section.

(b) Flexural tensile stresses will act at top fibre and flexural compressive stresses will act at bottom fibre of the section.

(c) Maximum shear stresses will act at junction of flange and web, and zero at neutral axis of the section.

(d) Maximum shear stresses will act at neutral axis of the section.

(1) (a) and (c)  
(2) (b) and (c)  
(3) (a) and (d)  
(4) (b) and (d)

कल्याण कामासाठी जाणा /SPACE FOR ROUGH WORK

P.T.O.
25. Consider that a steel bar of diameter ‘d’ is embedded in a large concrete block. If length of bar embedded in concrete is ‘L’ and bond strength between concrete and bar is $\tau_{bd}$, what maximum force can be applied on the bar?

1. Maximum of $0.87 f_y \frac{\pi}{4} d^2$ and $\tau_{bd} \pi d L$

2. Maximum of $\tau_{bd} \frac{\pi}{4} d^2$ and $0.87 f_y \pi d L$

3. Minimum of $0.87 f_y \frac{\pi}{4} d^2$ and $\tau_{bd} \pi d L$

4. Minimum of $\tau_{bd} \frac{\pi}{4} d^2$ and $0.87 f_y \pi d L$

26. A RCC beam of width 300 mm and effective depth 600 mm is made up of concrete with $\tau_{\text{cmax}} = 2$ MPa. For reinforcement provided and grade of concrete used $f_y = 0.7$ MPa, factored shear force acting on the beam is 400 kN. Shear reinforcement shall be designed for:

1. 360 kN
2. 274 kN
3. 400 kN
4. Section needs to be redesigned

27. A RCC beam of width 300 mm and effective depth 600 mm is made up of concrete with $\tau_{\text{cmax}} = 2$ MPa. For reinforcement provided and grade of concrete used $f_y = 0.7$ MPa, factored shear force acting on the beam is 400 kN. Shear reinforcement shall be designed for:

1. 360 kN
2. 274 kN
3. 400 kN
4. Section needs to be redesigned

28. A two way slab is defined as:

1. Supported on all four edges and $\frac{I_y}{I_x} > 2$

2. Supported on all four edges and $\frac{I_y}{I_x} < 2$

3. $\frac{I_y}{I_x} < 2$

4. $\frac{I_y}{I_x} > 2$

कवच्या कामासाठी जाण्या /SPACE FOR ROUGH WORK
29. For a simply supported two way slab with corners held down, area of steel required in short direction for maximum B.M. is 400 mm$^2$ and in long direction 300 mm$^2$. The torsion steel required at the corners shall be:

1. 300 mm$^2$ both ways at top and bottom
2. 225 mm$^2$ both ways at top and bottom
3. 100 mm$^2$ both ways at top and bottom
4. none of the above

30. An element has a tensile stress of 6 MPa and a compressive stress of 4 MPa acting on two mutually perpendicular planes with two equal shear stresses of $\sqrt{11}$ MPa. What is the principal tensile stress acting?

1. 7 MPa
2. 4 MPa
3. $10 + \sqrt{11}$ MPa
4. 10 MPa

31. The equation of a three hinged parabolic arch with origin at its left support is $y = x - (x^2/40)$. The span of the arch is 48 m. The arch is carrying a uniformly distributed load of 20 KN/m over left half of the span. The horizontal reaction at the support:

1. 120 KN
2. 360 KN
3. 300 KN
4. 383.41 KN

32. Consistent displacement or compatibility condition means:

1. displacements caused by redundant forces
2. displacements caused by the forces other than redundant forces
3. displacements caused by the redundant and applied forces
4. displacements caused by redundant and applied forces satisfying boundary conditions

33. A column carrying axial load of 1000 kN is to be designed for effective length of 4.50 m and cross-section 300 x 600 mm. As per IS 456-2000 the column should be designed as:

1. axially loaded column
2. eccentrically loaded column
3. short column
4. none of above
34. Isochrone depicts:
   (1) Pore pressure \(U_e\) versus depth \(z\)
   (2) Pore pressure \(U_e\) versus time \(t\)
   (3) Pore pressure \(U_e\) time factor of consolidation \(T_v\)
   (4) All of the above

35. A saturated sand becomes "quick" or "alive" when the hydraulic gradient is approximately equal to:
   (1) zero \(0\)  (2) minus one \(-1\) (3) one \(1\)  (4) Infinity \(\infty\)

36. Terzaghi demonstrated the spring analogy theory to understand the mechanics of:
   (1) Compaction  (2) Consolidation  (3) Seepage  (4) Permeability

37. Static penetration test is covered under which IS code?
   (1) IS 1888 : 1982  (2) IS 4968 (P3) 1987
   (3) IS 2131 : 1981  (4) IS 2720 (P4) 1985

38. A pile foundation is used when:
   (1) The loads are heavy  (2) Soil stratum near ground surface is weak
   (3) Both (1) and (2)  (4) Neither (1) nor (2)

39. Clay mineral kaolinite is formed due to chemical weathering of:
   (1) Garnet  (2) Quartz  (3) Feldspar  (4) Sillimanite

40. As per Indian standard compaction test, which are the respective values of weight of rammer and its falling height for heavy compaction?
   (1) 26 N and 310 mm  (2) 30.3 N and 350 mm
   (3) 48.9 N and 450 mm  (4) 60 N and 400 mm

41. As per Terzaghi theory, \(N_c\), \(N_q\) and \(N_r\) are known as:
   (1) Shear strength factors  (2) Earth pressure coefficients
   (3) Bearing capacity factors  (4) Compaction factors
42. For obtaining allowable load from single pile load test (dop : IS 2911-P1-1964) data, which of the following criteria is applicable:

(1) 50% of ultimate load at which total settlement amounts to one tenth of the pile diameter

(2) \( \frac{2}{3} \) of the load which causes total settlement of 12 mm.

(3) \( \frac{2}{3} \) of the load which causes total settlement of 6 mm.

(4) All of the above

43. The degree of disturbance of sample which is measured in terms of Area ratio 'Ar' is defined as:

(1) \( Ar = \frac{A_o - A_i}{A_i} \times 100 \)

(2) \( Ar = \frac{A_o + A_i}{A_i} \times 100 \)

(3) \( Ar = \frac{A_o \times A_i}{A_i} \times 100 \)

(4) None of the above

44. Match List - I with List - II, and select correct answer using codes given below:

<table>
<thead>
<tr>
<th>List - I</th>
<th>List - II</th>
</tr>
</thead>
<tbody>
<tr>
<td>(a) Pycnometer</td>
<td>(i) Classification of fine grained soil</td>
</tr>
<tr>
<td>(b) Core cutter</td>
<td>(ii) Grain size analysis</td>
</tr>
<tr>
<td>(c) Plasticity chart</td>
<td>(iii) Field density</td>
</tr>
<tr>
<td>(d) Mechanical sieve analysis</td>
<td>(iv) Specific gravity</td>
</tr>
</tbody>
</table>

Codes:

(a) (b) (c) (d)

(1) (iv) (ii) (i) (iii)

(2) (ii) (iii) (i) (iv)

(3) (iv) (iii) (i) (ii)

(4) (ii) (iv) (i) (iii)
45. A group of 4 piles with two piles in a row were driven into a soft clay extending from ground level to a great depth. The piles were placed 90 cm c/c with a pile diameter 30 cm and length 8 m. The UCS (Unconfined Compressive Strength) of soft clay is 60 kPa. Compute allowable load on pile group (Assuming block failure) for a factor of safety 2 - 5?

(1) 1280 kN  (2) 1180 kN  (3) 1380 kN  (4) 1420 kN

46. Site A and site B had the same soil with single drainage. 8 m thick clay layer of site A took 1 year to achieve 50% degree of consolidation. To achieve the same degree of consolidation at site B having 16 m thick layer, the time required is:

(1) 4 yr  (2) 1 yr  (3) 16 yr  (4) 2 yr

47. The maximum shear stress under the centre of a continuous strip occurs at what depth beneath the centre? (If 'B' is width of the strip)

(1) B  (2) \frac{B}{2}  (3) \frac{3}{4}B  (4) 2B

48. The standard penetration test is useful to measure:

(1) consolidation characteristics of soft clays
(2) shear strength of sands
(3) consistency of clays
(4) none of the above

49. The shape of the hydrograph of runoff is affected by:

(1) The intensity of the storm  (2) The duration of the storm
(3) The real distribution of the storm  (4) All the above

50. The uplift pressure on the face of a drainage gallery in a dam is equal to:

(1) hydrostatic pressure at toe
(2) hydrostatic pressure at heel
(3) two-third of hydrostatic pressure at heel plus one-third of hydrostatic pressure at heel
(4) none of the above
51. The method of estimating high flood discharge is:

(1) By empirical formulae developed for the region
(2) By applying rational formulae
(3) By flood frequency studies
(4) All of the above

52. The flow-mass curve is a graphical representation of:

(1) Cumulative discharge and time
(2) Discharge and percentage probability of flow being equalled or exceeded
(3) Cumulative discharge, volume and time in chronological order
(4) Discharge and time in chronological order

53. What does the Guinbel's distribution method require of the annual flood series to estimate the magnitude of a flood with a return period of T years?

(1) mean value
(2) length of record
(3) standard deviation
(4) all of the above

54. The percentage of the total sediment flow depositing in the reservoir is called its:

(1) Capacity inflow ratio
(2) Sediment coefficient
(3) Trap efficiency
(4) Displacement efficiency

55. The relation between duty D in hectares/cu.m. depth of water $\Delta$ in m and base period in days $B$ is given by:

(1) $\Delta = 8.64 \frac{B}{D}$
(2) $\Delta = 8.64 \frac{D}{B}$
(3) $\Delta = 8.64 B$
(4) None of the above

Kabba Kabasa Jaga /SPACE FOR ROUGH WORK

P.T.O.
50. Trap efficiency of a storage reservoir is defined as ratio of:

\[
\frac{\text{Total annual sediment inflow}}{\text{Reservoir capacity}}
\]

(1)

\[
\frac{\text{Total sediment deposited in a given period}}{\text{Total sediment inflow in that period}}
\]

(2)

\[
\frac{\text{Total annual sediment deposited in the reservoir}}{\text{Dead storage capacity of the reservoir}}
\]

(3)

None of the above

(4)

57. Match the List - I with List - II

<table>
<thead>
<tr>
<th>List - I</th>
<th>List - II</th>
</tr>
</thead>
<tbody>
<tr>
<td>(a) Ingles formula</td>
<td>(i) North and central India</td>
</tr>
<tr>
<td>(b) Dicken's formula</td>
<td>(ii) Maharashtra state</td>
</tr>
<tr>
<td>(c) Ryvis formula</td>
<td>(iii) USA</td>
</tr>
<tr>
<td>(d) Greager's formula</td>
<td>(iv) South India</td>
</tr>
</tbody>
</table>

Codes:

(1) (ii) (i) (iv) (iii)
(2) (iii) (ii) (iv) (i)
(3) (ii) (i) (iii) (iv)
(4) (i) (iii) (ii) (iv)

58. For high ogge spillway $H_e = H_d$ and $C_d$ is found to be:

(1) 1.00
(2) 2.00
(3) 2.20
(4) 1.33

59. Presence of tail water in a gravity dam:

(a) increases the principal stress   (b) decreases the principal stress
(c) increases the shear stress     (d) decreases the shear stress

The correct answer is:

(1) (a) and (c)
(2) (a) and (d)
(3) (b) and (c)
(4) (b) and (d)

क्रमांक कामासाठी जाग /SPACE FOR ROUGH WORK
60. What affects the shape of the hydrograph?
   (1) non-uniform areal distribution of rainfall
   (2) varying rainfall intensity
   (3) shape of the basin
   (4) all the above factors

61. When a ship enters sea from a river one can expect it:
   (1) to rise a little
   (2) to sink a little
   (3) to remain at the same level of draft
   (4) to rise or fall depending on whether it is of wood or steel

62. An Aquifer confined at the bottom but open at the top is known as:
   (1) acquiclude
   (2) unconfined acquifer
   (3) semi confined acquifer
   (4) none of the above

63. Which of the following pollutant gases is produced due to anaerobic decomposition of organic matter in biological waste product?
   (1) Carbon-di-oxide (CO₂)
   (2) Sulphur-di-oxide (SO₂)
   (3) Carbon-mono-oxide (CO)
   (4) Hydrogen sulphide (H₂S)

64. The chemical characterization of solid waste includes:
   (1) Proximate and ultimate analysis
   (2) Density
   (3) Moisture content
   (4) None of the above

65. When, Iron and Manganese are present in combination with organic matter in water, they shall be removed by:
   (a) Aeration
   (b) Coagulation
   (c) Addition of lime
   (d) Addition of chlorine
   (1) (a) only
   (2) (b) only
   (3) (a) and (b)
   (4) (c) and (d)
66. The colour of water for domestic supplies on standard platinum cobalt scale should not exceed:

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<tbody>
<tr>
<td>(1)</td>
<td>0 - 5 PPM</td>
<td>(2)</td>
<td>5 - 10 PPM</td>
<td>(3)</td>
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67. A sedimentation tank is to be designed for a given capacity. The velocity of flow is 0.2 m/min and a detention period of 6 hours is to be considered. The length of the tank should be:

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<td>(1)</td>
<td>12 m</td>
<td>(2)</td>
<td>32 m</td>
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68. Acceptable noise level for residential and business urban areas as per IS 4954-1968 is:

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<tbody>
<tr>
<td>(1)</td>
<td>25 - 35 dB</td>
<td>(2)</td>
<td>40 - 50 dB</td>
<td>(3)</td>
</tr>
</tbody>
</table>

69. Following instruments are used to measure Turbidity characteristics of water:

(a) Jackson's Turbidimeter  
(b) Baylis Turbidimeter  
(c) Nephelometer  
(d) Ratio Turbidimeter  

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<tbody>
<tr>
<td>(1)</td>
<td>(a) and (b) only</td>
<td>(2)</td>
<td>(a), (b) and (d) only</td>
<td>(3)</td>
</tr>
</tbody>
</table>

70. Dechlorination of water is achieved by adding:

(a) Sodium thiosulphate  
(b) Sodium sulphite  
(c) Sodium hexametaphosphate  
(d) Sodium bisulphate  

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<tbody>
<tr>
<td>(1)</td>
<td>Only (a) and (c)</td>
<td>(2)</td>
<td>only (b)</td>
<td>(3)</td>
</tr>
</tbody>
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71. The solubility of oxygen in sewage when compared to its solubility in distilled water is:

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<tbody>
<tr>
<td>(1)</td>
<td>85%</td>
<td>(2)</td>
<td>95%</td>
<td>(3)</td>
</tr>
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</table>

कछुव्या कामासाठी जगा / SPACE FOR ROUGH WORK
72. Pollutant Standard Index (PSI) value greater than 100 upto 199, denotes the air quality as:
   (1) Good  (2) Moderate  (3) Unhealthy  (4) Hazardous

73. The chemical compounds which are responsible for production of photochemical smog are:
   (1) Hydrocarbons  (2) Nitrogen oxide
   (3) Both (1) and (2)  (4) None of the above

74. A 50 μm size particle is removed from gas by:
   (1) Gravity settling chamber  (2) Centrifugal collector
   (3) Wet scrubber  (4) Fabric filter

75. BOD (Bio-chemical Oxygen Demand) test is carried out for 5 days at a constant temperature of:
   (1) 10°C  (2) 37°C  (3) 25°C  (4) 20°C

76. Slow sand filter removes bacteria to as much as:
   (1) 80 - 90%  (2) 90 - 95%
   (3) 98 - 99%  (4) None of the above

77. The unit for measuring the frequency of sound is:
   (1) decibel (dB)  (2) hertz (Hz)
   (3) dobocon unit (Du)  (4) none of the above

78. Desire lines are plotted in:
   (1) Accident studies  (2) Speed studies
   (3) Origin and destination studies  (4) Traffic volume studies

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P.T.O.
79. Where ‘p’ is the pressure sustained in \( \frac{\text{kg}}{\text{cm}^2} \) and ‘\( \Delta \)’ is deflection in cm, then with reference to rigid pavement the modulus of subgrade reaction is given by:

\[
\begin{align*}
(1) & \quad \frac{P}{\Delta} \\
(2) & \quad \frac{2P}{\Delta} \\
(3) & \quad \frac{\Delta}{P} \\
(4) & \quad \text{None of these}
\end{align*}
\]

80. Maximum equivalent single wheel load as per IRC is:

\[
\begin{align*}
(1) & \quad 8160 \text{ kg} \\
(2) & \quad 4080 \text{ kg} \\
(3) & \quad 2040 \text{ kg} \\
(4) & \quad 1020 \text{ kg}
\end{align*}
\]

81. In traffic design, PCU means:

\[
\begin{align*}
(1) & \quad \text{Passenger Class Unit} \\
(2) & \quad \text{Passenger Category Unit} \\
(3) & \quad \text{Passenger Car Unit} \\
(4) & \quad \text{none of the above}
\end{align*}
\]

82. On a right angled road intersection with two-way traffic, the total number of conflict points are:

\[
\begin{align*}
(1) & \quad 22 \\
(2) & \quad 24 \\
(3) & \quad 26 \\
(4) & \quad 28
\end{align*}
\]

83. Compared to a level road, on a descending grade the stopping sight distance is:

\[
\begin{align*}
(1) & \quad \text{Less} \\
(2) & \quad \text{More} \\
(3) & \quad \text{Same} \\
(4) & \quad \text{Depending on a speed}
\end{align*}
\]

84. ‘Stop’ sign is a:

\[
\begin{align*}
(1) & \quad \text{Warning sign} \\
(2) & \quad \text{Informatory sign} \\
(3) & \quad \text{Regulatory sign} \\
(4) & \quad \text{None of these}
\end{align*}
\]
85. Which of the following shapes is preferred in valley curve?

(1) Spiral  (2) Lemniscate
(3) Cubic parabola  (4) Simple parabola

86. Map is a graphical representation of the features on small scale as projected on a:

(1) horizontal plane  (2) horizontal line
(3) plane parallel to feature  (4) in any plane

87. If N is number of sides of a closed traverse, then the sum of included angles should be:

(1) \((2N + 4) \times 90^\circ\)  (2) \((2N - 4) \times 90^\circ\)  (3) \(360^\circ\)  (4) \((2N \pm 4) \times 90^\circ\)

88. The tension at which the effect of pull is neutralised by the effect of sag is known as:

(1) appropriate tension  (2) neutral tension
(3) equal tension  (4) normal tension

89. A chain of nominal length 30m is found to be 0.30m too long. If the area of the field measured with this defective chain is 300 hectares, the correct area of the field is:

(1) 294.03 hectares  (2) 300.03 hectares  (3) 306.03 hectares  (4) 300 hectares

90. The R.L. of the ground level is 100m. The levelling staff reading on the ground surface is 1.355m. The staff reading 2.355m is recorded when the levelling staff is held inverted touching its bottom to the base of chajja. The height of chajja from the ground will be:

(1) 103.071 m  (2) 1.0 m  (3) 101.00 m  (4) 3.71 m

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P.T.O.
91. If R is the radius of the circular curve and \( \phi \) is the deflection angle, then tangent length of the curve is given by:

(i) \( R \tan \frac{\phi}{2} \)  (2) \( R \tan \phi \)  (3) \( R \tan \frac{\phi}{4} \)  (4) \( R \tan \frac{\phi}{8} \)

92. Precision represents repeatability of a measurement and is concerned with only:

(1) Natural errors  (2) Instrumental errors
(3) Personal errors  (4) Random errors

93. Terpentine Oil is used in paints as a:

(1) Base  (2) Carrier  (3) Thinner  (4) Pigment

94. The four essential constituents of ordinary portland cement are in order of decreasing proportions:

(1) Lime, Silica, Alumina and Iron oxides
(2) Silica, Alumina, Iron oxides and Lime
(3) Alumina, Silica, Lime and Iron oxides
(4) Iron oxides, Alumina, Lime and Silica

95. **Assertion (A):** National building code of India recommends a minimum frontage of 6m on any road.

**Reasoning (R₁):** It prevents the formation of blind corners at the intersection of the streets and prevents accidents.

**Reasoning (R₂):** It prevents the building from dust and noise of the street.

Which of the following statements is correct?

(1) A, R₁ and R₂ are true. R₁ is incorrect explanation and R₂ is correct explanation of A.
(2) A is true. R₁ and R₂ are incorrect.
(3) A, R₁ and R₂ are true. But R₁ and R₂ are not correct explanations of A.
(4) A, R₁ and R₂ are true. R₁ and R₂ are correct explanations of A.
96. Quantities of wood work are computed generally in terms of:
   (1) Numbers       (2) Numbers and sizes
   (3) Area in square meters (4) Volume in cubic meters

97. The average water absorption as an acceptance criteria for bricks higher than class 12.5
shall be limited to:
   (1) 20%          (2) 10%        (3) 15%        (4) 8%

98. Final setting time of Ordinary Portland cement is not more than:
   (1) 60 minutes    (2) 600 minutes (3) 30 minutes (4) 300 minutes

99. The durability and gloss of a paint is:
   (1) Not related to PVCN (2) Directly proportional to PVCN
   (3) Inversely proportional to PVCN (4) Balanced when PVCN = 0

100. What is the ideal temperature for the promotion of alkali aggregate reaction?
   (1) 20°C - 40°C   (2) 25°C - 50°C   (3) 10°C - 38°C   (4) 18°C - 38°C

- o O o -
सूचना — (पृष्ठ 1 वर्तन पुढे...)।

(8) प्रस्तुतपदभित्र विषयिक केलेल्या बिष्यांत जागीच कोणते काम (रूप रब्बर) करावे. प्रस्तुतपदभित्र विषयिक कर्मचारीय उपरांतील कर इतर कामदार कोणते काम करावयास ते कौनती कर्मचारी उदेश्याने केले आहे, असे मानले जाईल व तांती उपरांतील कर शासनांने जारी केलेल्या "परिस्थितीमध्ये होणारा गैर प्रकरणारा प्रतिक्रिया करण्यासाठी अधिनियम-82" यांतील तत्तांदणीपुर्या कर्मचारी क्रमात येईल व तीची आवश्यक कमाल एक विषयांत कारावासाचा आयाम/किंवा रुपांपणे एक हजार राजमेंत्र्य तंडायचा शिक्षेंस पात्र होईल.

(9) सदर प्रस्तुतपदभित्र आयोगाचे विषयिक केलेल्या वेळ अपेक्षाने उत्तर देणार्‌ही प्रस्तुतपदभित्र करंट-बंडौरे परीक्षणांकांमध्ये बेहोळ जागीच पलिरांगणी आहे. याचा परीक्षण क्रमांकांचा जाणनांपूर्वी उमेदवाराचे आपल्या उत्तरप्रज्ञेयकु घाग-1 समवेशकांक्यें न विसरलं पत्र करणे आवश्यक आहे.

नमुना प्रश्न

Pick out the correct word to fill in the blank:

Q.No. 201. I congratulate you ________ your grand success.

(1) for (2) at (3) on (4) about

हा प्रश्नाचे योग्य उत्तर "(3) on" असे आहे. त्यापुढे या प्रश्नाचे उत्तर "(3) on" होईल. यासाठी खालीलप्रमाणे प्रश्न क्रूं. 201 समस्तप्रमाणे उत्तर-क्रमांक "(3) on" हे वर्तून पूर्णपयो यावकित करून दाखविला आवश्यक आहे.

प्र. क्रेन 201. 1 2 3 4

अशा पद्धतीने प्रस्तुत प्रस्तुतपदभित्र प्रश्नाचा तुपचा उत्तरक्रमांक हा तुम्हाच्या स्वतंत्रतीत पुर्वलेल्या उत्तरप्रज्ञेयकु घाग तथा त्या प्रश्नक्रमकामें फर्तीत वर्तून पूर्णपयो यावकित करून दाखवावा. झाकर्ष्टिता फक्त काळ्या आईले बाल्यपणे वापरते, पेनसिल वा आईले पेन वापरते.