(1) सदर प्रस्तुतिकर्ता 100 अभियंत्री प्रस्तुत आहेत. उदेश्यांनी प्रधानपर उत्तर लिखितपणे मुहूर्तत करणारे पूर्वी या प्रस्तुतिकर्ते सर्व प्रस्तुतीत किंवा नाहीत.त्यारी खाती करण्याची, असा त्याचे अन्य काही दोष आढळतयास ही प्रस्तुतिकर्ता समवेदनाकुंद बदलू लागू नये.

(2) आपले परिवार-क्रमांक हा चौकोनात न विस्तार बांधतील राहावे.

(3) या अभियंत्यांनी प्रस्तुति क्रमांक, तुम्मांचा उद्दिष्टके विशिष्ट जागा उत्तरपत्रकेल्या सुचविल्यास न विस्तार माणूस करावा.

(4) प्रस्तुतिकर्तील प्रश्नाला 4 पर्यंत उद्दिष्टके असलेल्या प्रश्नांच्या 1, 2, 3 आणि 4 असे क्रमांक दिली आहेत. त्याच्यावर उत्तराची संबंधी योग्य उत्तरवऱ्या क्रमांक, उत्तरपत्रकेल्या सुचविल्यास तुम्मांचा उत्तरपत्रके माणूस करावा. असा प्रश्नाला उत्तरपत्रके अर्थात क्रमांक संबंधीत प्रश्नावर नसेल तर उत्तरपत्रके पत्त्यानंतरप्रथम प्रश्नाने घराला जाईल पाहीला असेल त्याची काळी याची. हा अभियंत्याची फक्त प्रश्नाच्या शायदे बांधतो वापर, वेळत व शायदे येते वापर नये.

(5) सर्व प्रश्नांपासून कोणता आहे. या चैलेंज या प्रश्नांमध्ये उत्तर देणं आवश्यक आहे. अभियंत्याचे नियम भरून करावे. अभियंत्यांनी प्रश्न करण्यासाठी वाचवणे व ध्यानदायी पूर्ण करणे फक्त उत्तराचा उत्तर वापर करता. अभियंत्यांनी प्रश्नांनी उत्तरपत्रके पृष्ठभूमीनंतर वेळी विशेष विश्वसनीयता करीत अर्थात पूर्ण विस्तृत प्रश्नांकें पत्त्यानंतरप्रथम पत्त्यानंतर केलेले वापर केले.

(6) उत्तरपत्रके एकदा माणूस केले तर झोंकू नये. नमुद केलेले उद्दिष्ट्याच्या अनुसार उत्तरदेण्यास तपासात आहे. अवश्य नाही, तर झोंकू नये.

(7) प्रश्नांच्या उत्तरांच्या मूल्यांकन करताना उदेश्यासारखे पूर्णतत्त्व योग्य उत्तरांना गुण दिले जाते. तसेच "प्रश्नांना विचार्यांनी मूल्यांकन करताना योग्य उत्तरांना गुण दिले जाते. तसेच "प्रश्नांमध्ये विचारांचा गैर-उत्तरांचा प्रतिबंध करणारा उत्तरांचा अर्जित नाही." वातावरणात तसेच प्रश्नांच्या उत्तरांना गुण दिले जाते. तसेच "प्रश्नांमध्ये विचारांचा गैर-उत्तरांचा प्रतिबंध करणार्या उत्तरांचा अर्जित नाही." वातावरणात सर्व उत्तरांमध्ये गुण दिले जाते. तसेच "प्रश्नांमध्ये विचारांचा गैर-उत्तरांचा प्रतिबंध करणार्या उत्तरांचा अर्जित नाही." वातावरणात सर्व उत्तरांमध्ये गुण दिले जाते. तसेच "प्रश्नांमध्ये विचारांचा गैर-उत्तरांचा प्रतिबंध करणार्या उत्तरांचा अर्जित नाही." वातावरणात सर्व उत्तरांमध्ये गुण दिले जाते.

पृष्ठभूमी प्रश्नातील प्रश्नांमध्ये अन्तिम पृष्ठावर पाहा.
SPACE FOR ROUGH WORK
1. Which of the following is not a test for measuring workability of concrete?
   (1) Slump Test  (2) Flow Test
   (3) Std. Consistency Test  (4) Kelly Ball Test

2. The stone whose crushing strength is maximum, is:
   (1) granite  (2) chalk  (3) slate  (4) marble

3. As per the Building Byelaws, how much should be the marginal distance that is to be left in the front?
   (1) At least 3 m  (2) At least 5 m
   (3) More than 5 m  (4) More than 10 m

4. Generally at what rate should slip form be lifted?
   (1) 1 m per hour  (2) 5 - 10 cm per hour
   (3) 20 - 30 cm per hour  (4) 50 - 60 cm per hour

5. What is a Mullion in a window shutter?
   (1) Vertical member running through shutter of window.
   (2) Horizontal member of shutter.
   (3) Inclined batten.
   (4) None of the above

6. How much is the covering capacity of cement paint?
   (1) About 18 m^2/kg per coat  (2) About 20 m^2/kg per coat
   (3) About 12 m^2/kg per coat  (4) About 4 m^2/kg per coat

7. As per IS specifications, the heat of hydration of low-heat portland cement for 28 days is:
   (1) Not more than 100 calories/gm  (2) Not more than 50 calories/gm
   (3) Not more than 75 calories/gm  (4) Not more than 150 calories/gm

कच्चा कामासाठे जागा /SPACE FOR ROUGH WORK

P.T.O.
8. Which of the following is not a principle of _______ planning?
   (1) Aspect  (2) Floor Area Ratio
   (3) Roominess  (4) Prospect

9. To what is Ease related in concrete technology?
   (1) Geology of fresh concrete  (2) Rheology of fresh concrete
   (3) Mineralogy of fresh concrete  (4) Ecology of fresh concrete

10. What does not fit into the classification of pile based on function?
    (1) Bearing pile  (2) Friction pile
     (3) Compaction pile  (4) Steel pile

11. Acceptable noise level in dB for auditorium is:
    (1) 25 to 30  (2) 40 to 45  (3) 35 to 40  (4) 45 to 55

12. Cavity or hollow space in a wall is provided for:
    (a) Prevention of dampness  (b) Heat insulation
    (c) Sound insulation  (d) Efflorescence
    Answer options:
    (1) (a) and (b)  (2) (a) and (c)
     (3) (a), (b) and (d)  (4) (a), (b), (c) and (d)

13. If a solid shaft is subjected to a torque (T) at its end such that maximum shear stress does not exceed \( f_s \), the diameter of the shaft will be:
    (1) \( \frac{16T}{\pi f_s} \)  (2) \( \left( \frac{16T}{\pi f_s} \right)^{\frac{1}{2}} \)
     (3) \( \left( \frac{16T}{\pi f_s} \right)^{\frac{1}{3}} \)  (4) None of these

क्रमचय कामासाठी जाणा /SPACE FOR ROUGH WORK
14. Maximum deflection of a cantilever due to pure moment 'M' at its free end, is:

\[
\begin{align*}
(1) \quad & \frac{ML^2}{3EI} \\
(2) \quad & \frac{ML^2}{4EI} \\
(3) \quad & \frac{ML^2}{2EI} \\
(4) \quad & \frac{ML^2}{6EI}
\end{align*}
\]

15. If the load on a column is increased to a value that on its removal the deflection remains, the load is known as:

\[
\begin{align*}
(1) \quad & \text{Critical load} \\
(2) \quad & \text{Crippling load} \\
(3) \quad & \text{Buckling load} \\
(4) \quad & \text{All of these}
\end{align*}
\]

16. Magnitude of shear stress induced in a shaft due to applied torque varies from:

\[
\begin{align*}
(1) \quad & \text{Maximum at centre to zero at circumference} \\
(2) \quad & \text{Maximum at centre to minimum (Not Zero) at the circumference} \\
(3) \quad & \text{Zero at centre to maximum at circumference} \\
(4) \quad & \text{Minimum (Not Zero) at centre to maximum at circumference}
\end{align*}
\]

17. The ratio of the flexural strengths of two beams of square cross section, the first beam being placed with its top and bottom sides horizontally and second beam being placed with one diagonal horizontally, is:

\[
\begin{align*}
(1) \quad & \sqrt{3} \\
(2) \quad & \frac{1}{\sqrt{3}} \\
(3) \quad & \frac{1}{\sqrt{2}} \\
(4) \quad & \sqrt{2}
\end{align*}
\]

18. In an experiment it is found that the bulk modulus of a material is equal to its shear modulus then the Poisson's ratio is:

\[
\begin{align*}
(1) \quad & 0.125 \\
(2) \quad & 0.250 \\
(3) \quad & 0.375 \\
(4) \quad & 0.500
\end{align*}
\]

19. The beam AC simply supported at A and at C is pinned to a cantilever beam CD as shown in figure. Both beams have identical flexural rigidities EI. The vertical load of 8 kN acts at point B. The deflection of point B is:

\[
\begin{align*}
(1) \quad & \frac{2.25}{EI} \\
(2) \quad & \frac{4.5}{EI} \\
(3) \quad & \frac{6.75}{EI} \\
(4) \quad & \frac{8}{EI}
\end{align*}
\]

कविता कामासाठी जागा /SPACE FOR ROUGH WORK

P.T.O.
20. What is true if the areas of cross-section of square and circular beams, subjected to equal bending moments are the same?

(1) circular beam is more economical
(2) square beam is more economical
(3) both the beams are equally strong
(4) both the beams are equally economical

21. Two rods of different materials having coefficient of linear expansion $\alpha_1$, $\alpha_2$ and Young’s moduli $E_1$, $E_2$ respectively are fixed between to massive walls. The rods are heated such that they undergo the same increase in temperature. There is no bending of the rods. If $\alpha_1 : \alpha_2 = 2 : 3$, the thermal stresses are equal, what is the ratio of $E_1$ to $E_2$?

(1) 2 : 3  (2) 1 : 1  (3) 3 : 2  (4) 4 : 9

22. The phenomenon of slow growth of strain under a steady stress is called:

(1) yielding  (2) creeping
(3) breaking  (4) none of the above

23. A rectangular timber beam $(b \times d)$ is cut out of a cylindrical log of diameter ‘$D$’. The width ($b$) of the strongest timber beam will be:

(1) $\sqrt{3} \, D$  (2) $\frac{D}{\sqrt{3}}$  (3) $\sqrt{2} \, D$  (4) $\frac{D}{\sqrt{2}}$

24. A rigid frame detailed to provide good ductility and support for both lateral and gravity loads by flexural action is called:

(1) Ordinary moment resisting frame
(2) Intermediate moment resisting frame
(3) Special moment resisting frame
(4) All of the above

कच्च्या कामासाठी जागा /SPACE FOR ROUGH WORK
25. A fixed base symmetrical frame is shown in the figure write slope deflection equation for moment at B for member AB:

\[ M_{BA} = 0.5 \ EI \theta_B \]
\[ M_{BA} = EI \theta_B \]
\[ M_{BA} = 0.5 \ EI \theta_A \]
\[ M_{BA} = EI \theta_A \]

26. A propped cantilever is subjected to a concentrated load of 16 kN at the centre of the span. The length of beam is 4 m. The flexural rigidity \( EI = 4 \times 10^2 \) kNm\(^2\). The reactions at the fixed end and simply supported end are:

(1) 9.87 kN at fixed end and 6.13 kN at simply supported end
(2) 8 kN each at fixed end and simply supported end
(3) 11 kN at fixed end and 5 kN at simply supported end
(4) 16 kN at fixed end and zero kN at simply supported end

27. Fill in the blanks:

The primary unknowns in slope deflection methods are ________ and obtained by solving ________ equations.

(1) rotational and translational displacements, joint force equilibrium
(2) moment and forces, compatibility
(3) stiffness and flexibility, differential
(4) none of the above

28. A rigid jointed frame with three bays and two stories has two fixed column supports and two hinged. The degree of static indeterminacy of structure is:

(1) 25 (2) 27 (3) 18 (4) 16

कक्ष्या कामासाठी जागा /SPACE FOR ROUGH WORK

P.T.O.
29. Three prismatic members AB, BC and BD meet at a joint for a rigid frame to be analysed using moment distribution method. The distribution factors for members AB and BC are 0.5 and 0.3 respectively. The distribution factor for member BD shall be:

\[
\begin{align*}
(1) & \quad 0.2 \\
(2) & \quad 1.67 \\
(3) & \quad 0.6 \\
(4) & \quad 0.15
\end{align*}
\]

30. A propped cantilever of span ‘L’ fixed at A and simply supported at B is subjected to concentrated load ‘W’ at centre, reaction at B:

\[
\begin{align*}
(1) & \quad \frac{3}{16} W \\
(2) & \quad \frac{W}{4} \\
(3) & \quad \frac{5}{16} W \\
(4) & \quad \frac{7}{16} W
\end{align*}
\]

31. A rigid frame ABCD with vertical members AB and CD is pinned at A and roller supported at ‘D’. Horizontal member BC is loaded with vertical point load of 90 kN at the centre of BC. AB = BC = CD = 3 m. If support A rotates by \(\frac{1}{300}\) rad. and also sinks downward by 30 mm. The reactions at A and D:

(1) shall be affected due to rotation and sinking
(2) shall not be affected due to rotation and sinking
(3) reaction at A shall change but reaction at B shall not change due to rotation and sinking
(4) none of the above

32. A moment ‘K’ required to rotate near end of a prismatic beam through a unit angle without translation, the far end being freely supported is given by:

\[
\begin{align*}
(1) & \quad K = \frac{3EI}{L} \\
(2) & \quad K = \frac{4EI}{L} \\
(3) & \quad K = \frac{EI}{L} \\
(4) & \quad K = \frac{L}{EI}
\end{align*}
\]

33. A truss deflection is to be calculated for a point ‘X’ using unit load method. Find the contribution to deflection by a truss member having details as below:

Lenght = 8.00 m  \quad \text{Area} = 11.25 \times 10^{-3} \text{ m}^2

\text{Internal force resisted by member under actual loading condition} = 450 \text{ kN (compression)}

\text{Modulus of elasticity} = 200 \times 10^6 \text{ kN/m}^2

\text{Internal force after unit load application} = 0.0 \text{ kN}

\[
\begin{align*}
(1) & \quad -0.5 \text{ mm} \\
(2) & \quad +0.5 \text{ mm} \\
(3) & \quad -1.6 \text{ mm} \\
(4) & \quad \text{Zero}
\end{align*}
\]
34. A continuous beam ABCD has end A as fixed and support B and C are simple supports while end D is free. The fixed end moments for beam AB are $FEM_{AB} = -19.2 \text{ kNm}$ and $FEM_{BA} = 28.8 \text{ kNm}$. The moment equation for slope deflection method for beam AB can be written as:

(1) $M_{ab} = \frac{2 EI}{L} (2\theta_A + \theta_B) + 28.8$

$M_{ba} = \frac{2 EI}{L} (\theta_A + 2\theta_B) - 19.2$

(2) $M_{ab} = \frac{2 EI}{L} (\theta_A) - 19.2$

$M_{ba} = \frac{4 EI}{L} (\theta_A) + 28.8$

(3) $M_{ab} = \frac{4 EI}{L} (\theta_A) - 19.2$

$M_{ba} = \frac{2 EI}{L} (\theta_A) + 28.8$

(4) $M_{ab} = \frac{2 EI}{L} (\theta_B) - 19.2$

$M_{ba} = \frac{4 EI}{L} (\theta_B) + 28.8$

35. The degree of static indeterminacy of pin-jointed space frame is given by:

(1) $m + r - 2j$  (2) $m + r - 3j$  (3) $3m + r - 3j$  (4) $m + r + 3j$

Where ‘$m$’ = the number of unknown member forces
‘$r$’ = unknown reaction components and
‘$j$’ = the number of joints.

36. If load system applied on the arch is entirely vertical the horizontal thrust at each of the supports must be:

(1) Same  (2) Different

(3) Zero  (4) None of the above

कच्च्या कामासाठी जाणा /SPACE FOR ROUGH WORK

P.T.O.
37. If \( k_i \) is the stiffness of \( i^{th} \) member at a joint, the distribution factor for the member is:

\[
\begin{align*}
(1) & \quad k_i \\
(2) & \quad \frac{k_i}{\Sigma k_i} \\
(3) & \quad \Sigma k_i \\
(4) & \quad (\Sigma k_i - k_i)
\end{align*}
\]

38. The Kinematic Indeterminacy of a frame as shown is:

\[\text{(1) } KI = 1 \quad \text{(2) } KI = 2 \quad \text{(3) } KI = 3 \quad \text{(4) } KI = 5\]

39. A rigid frame ABCD has AB member as overhang, with end 'A' being free. Supports C and D are fixed. DB is vertical member and BC is horizontal member. DB = BC = 5 m. If the moment equations are given by:

\[
\begin{align*}
M_{DB} &= 0.4 \frac{EI}{\theta_B} \\
M_{BD} &= 0.8 \frac{EI}{\theta_B} \\
M_{BA} &= 54 \\
M_{BC} &= -135 + 1.6 \frac{EI}{\theta_B}
\end{align*}
\]

\( M_{CB} = 135 + 1.6 \frac{EI}{\theta_B} \text{ then } \theta_B \) rotation at B is given by:

\[
\begin{align*}
(1) & \quad \frac{-112.5}{EI} \\
(2) & \quad \frac{33.75}{EI} \\
(3) & \quad Zero \\
(4) & \quad \text{None of the above}
\end{align*}
\]

40. The fixed end moment for the beam loaded is:

\[\text{W} \quad \text{L}
\]

\[
\begin{align*}
(1) & \quad - \frac{WL^2}{10} \text{ and } + \frac{WL^2}{20} \\
(2) & \quad - \frac{WL^2}{30} \text{ and } + \frac{WL^2}{20} \\
(3) & \quad + \frac{WL^2}{20} \text{ and } - \frac{WL^2}{30} \\
(4) & \quad - \frac{WL^2}{15} \text{ and } - \frac{WL^2}{15}
\end{align*}
\]

कण्ठा कक्षासाठी जाणा /SPACE FOR ROUGH WORK
41. If unit load moves from left to right on S.S. beam the nature of ILD for reaction is :
   (1) Parabolic          (2) Hyperbolic
   (3) Horizontal Straight Line       (4) Inclined Straight Line

42. A portal frame consisting of three members is pinned at both the supports. All the members have same value of EI. The frame has height of 3 m and width of 4 m. It is subjected to horizontal load at top beam level of \( P = 10 \text{ kN} \) in the plane of frame. Calculate maximum moment in the frame using approximate method or otherwise :
   (1) 15 kNm          (2) 10 kNm          (3) 30 kNm          (4) 7.5 kNm

43. The influence line for bending moment at section \( X(M_X) \) at a distance of 4 m from the left support of a simply supported girder AB is shown in figure below. A uniformly distributed load of intensity 2 t/m longer than the span crosses the girder from left to right.

![Influence line diagram]

The max bending moment at section \( X \) is equal to :
   (1) 12 tm          (2) 24 tm          (3) 48 tm          (4) 96 tm

44. A continuous beam has AB as one of the spans. It is subjected to fixed end moments at end A and B as \( \text{FEM}_A \) and \( \text{FEM}_B \) respectively under given loads. It has length 'L' and flexural rigidity EI. It rotates at end A and B by \( \theta_A \) and \( \theta_B \) respectively. The member axis rotates through clockwise angle \( R = \frac{\Delta}{L} \). The moment at end A is given by :

\[
(1) \quad M_A = \text{FEM}_B + \frac{4EI}{L} (2\theta_A + \theta_B - 3R)
\]

\[
(2) \quad M_A = \text{FEM}_A + \frac{2EI}{L} (2\theta_A + \theta_B - 3R)
\]

\[
(3) \quad M_A = \text{FEM}_A + \frac{4EI}{L} (2\theta_A + \theta_B + 3R)
\]

(4) None of the above

\[ \text{कच्च्या कापासाठी जग्या} / \text{SPACE FOR ROUGH WORK} \]

P.T.O.
45. What is the shear equation in slope deflection method for the portal frame shown below?

\[ \frac{M_{AB} + M_{BA}}{L} + \frac{M_{CD} + M_{DC}}{L} + P = 0 \]

\[ \frac{M_{AB} + M_{BA}}{L} + \frac{M_{BC} + M_{CB}}{L} + P = 0 \]

\[ \frac{M_{BC} + M_{CB}}{L} + \frac{M_{CD} + M_{DC}}{L} + P = 0 \]

\[ \frac{M_{BC} + M_{CB}}{L} + P = 0 \]

46. A bolt is subjected to a shear stress of \( f_{sb} \) and a tensile stress of \( f_{tb} \). If the permissible stresses in shear and tension are \( f_{asb} \) and \( f_{atb} \) respectively then the stress should satisfy:

\[ \frac{f_{sb}}{f_{asb}} + \frac{f_{tb}}{f_{atb}} \leq 1.0 \]

\[ \left( \frac{f_{sb}}{f_{asb}} \right)^{1.4} + \left( \frac{f_{tb}}{f_{atb}} \right)^{1.4} \leq 1.0 \]

\[ \frac{f_{sb}}{f_{asb}} + \frac{f_{tb}}{f_{atb}} \leq 1.4 \]

\[ \left( \frac{f_{sb}}{f_{asb}} \right)^{2} + \left( \frac{f_{tb}}{f_{atb}} \right)^{2} \leq 1.0 \]

47. The failure of a column depends upon:

(1) weight of a column  (2) length of column
(3) slenderness ratio  (4) cross sectional area of column

कच्च्या कामासाठी जागा /SPACE FOR ROUGH WORK
48. In which form is the permissible stress in columns, $f$ by Merchant - Rankine's formula?

(1) $f \propto \frac{\pi^2 E}{\lambda^2}$

(2) $f \propto \frac{f_y}{1 + 0.2 \sec \left(\csc \lambda \sqrt{f}\right)}$

(3) $\frac{1}{(f)^n} \propto \frac{1}{(f_y)^n} + \frac{1}{(f_{cr})^n}$

(4) $f \propto \frac{f_y}{\phi + \sqrt{\phi^2 - \lambda^2}}$

49. The partial safety factors for dead load and leading live load in calculation of vertical deflection in a steel beam are:

(1) 1.0 and 1.0  (2) 1.0 and 1.2  (3) 1.2 and 1.0  (4) 1.2 and 1.2

50. A square base plate of 1200 mm x 1200 mm is provided under a column 15 MB 400, which is carrying an axial force of 1440 kN along with bending moments of 288 kNm and 144 kNm about its Major and Minor axes respectively.

The maximum pressure (neglecting poisson's effect) anywhere on the base plate is:

(1) 2.5 N/mm²  (2) 2.6 N/mm²  (3) 2.75 N/mm²  (4) 3.0 N/mm²

51. The effective throat thickness of a fillet weld depends upon:

(1) angle between fusion faces  (2) length of weld
(3) permissible shear stress  (4) type of weld

52. For plate girder shown in figure below by using what action is panel A designed?

(1) Simple post critical action  (2) Tension field action
(3) Bearing force action  (4) None of the above

कस्तखण्ड खालिस्तानी जागा /SPACE FOR ROUGH WORK

P.T.O.
53. The maximum permissible vertical deflection of a simply supported beam in non industrial buildings if the element is susceptible for cracking is:

(1) span/360  (2) span/350  (3) span/325  (4) span/300

54. Which of the options given below are true about how the commonly used structural steels are made?

(a) Very low carbon steels, < 0.1%
(b) Low carbon steel 0.1 to 0.25%
(c) Medium carbon steel 0.25 to 0.6%
(d) High carbon steel 0.6 to 1.1%

**Answer options:**

(1) (a) is true  (2) (a) and (b) are true  (3) (a), (b) and (c) are true  (4) All are true

55. Effective length of groove welds in case of butt joint is equal to:

(1) length of continuous full size weld.
(2) overall length of weld minus twice the size of weld.
(3) overall length of weld minus four times the size of weld.
(4) overall length of weld plus twice the size of weld.

56. For economical spacing of roof truss, if t, p and r are the costs of truss, purlin and roof covering respectively then:

(1) \( t = p + r \)  (2) \( t = 2p + r \)  (3) \( t = p + 3r \)  (4) \( t = p + 2r \)

57. Which statement is correct if splices are provided in the reinforcing bars?

(1) Lap splices shall not be used for bars larger than 30 mm diameter.
(2) For flexure tension; Lap length = \( L_d \) or 30 \( \phi \) whichever is greater.
(3) For direct tension; Lap length = 2 \( L_d \) or 24 \( \phi \) whichever is greater.
(4) For compression members; Lap length = \( L_d \) or 30 \( \phi \) whichever is greater.
58. Dead weight of waist slab of a stair case spanning longitudinally is calculated as:

\[(1) \quad 25D \sqrt{1 + \left(\frac{R}{T}\right)^2} \quad (2) \quad 25d \sqrt{1 + \left(\frac{R}{T}\right)^2}\]
\[(3) \quad 25D \sqrt{1 + \left(\frac{T}{R}\right)^2} \quad (4) \quad 25d \sqrt{1 + \left(\frac{T}{R}\right)^2}\]

59. In the design of cantilever retaining wall, if the angle of repose (\(\phi\)) is 30° then the relation between active earth pressure (\(Ka\)) and passive earth pressure (\(Kp\)) will be:

\[(1) \quad Ka = \frac{1}{3} Kp \quad (2) \quad Ka = 3 Kp \quad (3) \quad Ka = \frac{1}{9} Kp \quad (4) \quad Ka = 9 Kp\]

60. A continuous beam shall be deemed to be deep beam when, the ratio of effective span to overall depth is less than:

\[(1) \quad 2.0 \quad (2) \quad 2.5 \quad (3) \quad 1.5 \quad (4) \quad 1.0\]

61. If a circular water tank resting on the ground has 275 mm thickness then for M-25 grade concrete and Fe 415 steel, the minimum percentage of area of steel (\(A_{st}\)) provided is:

\[(1) \quad (0.12\%) \times bT \quad (2) \quad (0.16\%) \times bT \quad (3) \quad (0.20\%) \times bT \quad (4) \quad (0.24\%) \times bT\]

62. Substitute frame method is used to analyse the building frame if the frame is subjected to:

\[(1) \quad \text{Lateral loads due to wind} \quad (2) \quad \text{Lateral loads due to earthquake}\]
\[(3) \quad \text{Vertical live load only} \quad (4) \quad \text{Vertical dead load and live loads}\]

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63. Minimum depth of foundation calculated by Rankine's formula for the design of retaining wall is ____________.

Where, \( q_0 \) = safe bearing capacity of soil

\( \gamma \) = Density of soil,

\( \phi \) = Angle of repose

\[
\begin{align*}
(1) \quad \frac{\gamma}{q_0} & \left( \frac{1 - \sin \phi}{1 + \sin \phi} \right)^2 \\
(2) \quad \frac{q_0}{\gamma} & \left( \frac{1 - \sin \phi}{1 + \sin \phi} \right)^2 \\
(3) \quad \frac{\gamma}{q_0} & \left( \frac{1 + \sin \phi}{1 - \sin \phi} \right)^2 \\
(4) \quad \frac{q_0}{\gamma} & \left( \frac{1 + \sin \phi}{1 - \sin \phi} \right)^2
\end{align*}
\]

64. If 'L' is the length of cantilever slab measured parallel to the fixed edge, the effective width of the cantilever slab shall not exceed: (For slabs carrying concentrated load)

\[
\begin{align*}
(1) \quad \frac{L}{3} & \quad (2) \quad \frac{2L}{3} \\
(3) \quad \frac{L}{2} & \quad (4) \quad \frac{3L}{2}
\end{align*}
\]

65. In singly reinforced sections, when the section is under-reinforced, the relation between depth of neutral axis (\(x_u\)) and the limiting value of depth of neutral axis (\(x_{u, \text{max}}\)) is:

\(x_u = x_{u, \text{max}}\) max

\(x_u < x_{u, \text{max}}\) max

\(x_u > x_{u, \text{max}}\) max

(4) none of the above

66. Maximum reinforcement provided in a beam section shall not exceed ____________.

\[
\begin{align*}
(1) \quad \frac{0.85}{f_y} (bd) & \quad (2) \quad \frac{0.87}{f_y} (bd) \\
(3) \quad 0.04 (bd) & \quad (4) \quad 0.04 (bD)
\end{align*}
\]

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67. Match the minimum number of longitudinal steel bars required in columns as per cross section of column:

(a) Rectangular column  (i) 4
(b) Circular column  (ii) 5
(c) Octagonal column  (iii) 6
(iv) 8

Answer options:

(a) (b) (c)
(1) (i) (ii) (iii)
(2) (i) (iii) (iv)
(3) (iv) (iii) (i)
(4) (iii) (i) (iv)

68. A post tensioned prestressed concrete beam is tensioned successively by 4 cables of equal area and equal stress. The percentage loss in each cable is found to be 6%, 4%, 2% and 0% respectively. What will be the total percentage loss in prestressing force?

(1) 12% (2) 4% (3) 3% (4) 6%

69. In case of curved ducts, the loss of prestress depends upon the radius of curvature (R) of the duct and the coefficient of friction (μ) between duct surface and the tendon. The tension at any point of the cable distance ‘x’ from the end is given by ________.

(1) \( P_0 e^{-\frac{\mu R}{x}} \) (2) \( P_0 e^{-\mu R} \) (3) \( P_0 R e^{-\mu x} \) (4) \( P_0 e^{-\frac{\mu R}{x}} \)

70. The time dependent inelastic deformation of steel resulting from sustained stress and a function thereof is known as ________.

(1) Shrinkage (2) Creep (3) Deformation (4) Relaxation

71. In post-tensioned elements, the zone within which the applied prestressing force on steel is fully dissipated into concrete and made to act as a distributed force is known as ________.

(1) Transmission zone (2) Anchor zone
(3) Distribution zone (4) End block zone

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72. A simply supported prestressed concrete beam of span 10 m and subjected to U.D.L. of 30 kN/m (inclusive of self weight). A prestressing force of 1500 kN is applied through a parabolic cable having zero eccentricity at both ends and maximum value (h) at centre of span then what will be the dip (h) if load balancing concept is applied?

(1) 250 mm (2) 100 mm (3) 50 mm (4) 25 mm

73. Prestressed concrete members which are designed to allow significant tensile stresses to occur at service loads and such tensile regions are usually additionally reinforced with non-prestressed reinforcement are known as ________.

(1) Prestressing tension members (2) Fully prestressing members (3) Non-prestressing members (4) Partial prestressing members

74. A simply supported prestressed concrete beam of 300 x 500 mm in c/s is subjected to a superimposed load of 20 kN/m over a span of 10 m. If a prestressing force of 1000 kN is applied through a straight tendon located along centroidal axis then what is the extreme top fibre stress at the end support:

(1) 20 mPa (2) 26.67 mPa (3) 19.33 mPa (4) 6.67 mPa

75. Which statement is not applicable to prestressed concrete members?

(1) It combines high strength concrete with high strength steel in an active manner.
(2) High tension steel wires are used to transfer tensile stresses to concrete section.
(3) Prestressing the steel against the concrete to counter balance any tensile stress produced by dead load and live load.
(4) Load balancing concept enables the transformation of a flexure member into a member under direct stress.

76. For the production of pre-tensioned members on large scale, a system usually adopted is

(1) Gifford Udall System (2) Magnel Blaton System
(3) Hoyer System (4) P.S.C. Monowire System

77. When the tendons are placed at an eccentricity of ε, the extreme fibre stresses in beam are:

\[
\begin{align*}
(1) & \quad \frac{P}{A} + \frac{Pe}{Z} + \frac{M}{Z} \\
(2) & \quad \frac{P}{A} + \frac{Pe}{A} + \frac{M}{Z} \\
(3) & \quad \frac{P}{Z} + \frac{Pe}{Z} + \frac{M}{Z} \\
(4) & \quad \frac{P}{A} + \frac{Pe}{A} + \frac{M}{A}
\end{align*}
\]
78. In simply supported prestressed concrete beams with uniformly distributed loads over its entire span.

**Statement 1:** The size of limiting zone is maximum at supports and reduces towards the midspan.

**Statement 2:** The Bending moments due to uniformly distributed loads in a simply supported beam are zero at supports and maximum at midspan.

(1) **Statement 1** is true, statement 2 is true and statement 2 is the correct explanation of statement 1.

(2) **Statement 1** is true, statement 2 is true but statement 2 is not the correct explanation of statement 1.

(3) **Statement 1** is true and statement 2 is false.

(4) **Statement 1** is false and statement 2 is true.

79. The 'Force - Majeure' clause in a contract document generally refers to:

(1) Agitation and strikes only

(2) Epidemic of large proportion only

(3) (1) and (2) above

(4) None of the above

80. Injury frequency rate per lakh of man-hours worked is calculated as:

(1) \[
\frac{\text{No. of days lost} \times 1,00,000}{\text{No. of man-hours worked}}
\]

(2) \[
\frac{\text{No. of disabling injuries} \times 1,00,000}{\text{Total No. of man - hours worked}}
\]

(3) \[
\frac{\text{Injury frequency rate} \times \text{Injury service rate}}{1000}
\]

(4) \[
\frac{\text{No. of disabling injuries}}{\text{Total No. of man - hours worked}} \times 100
\]

81. Which of the following is not a type of fire extinguisher?

(1) Water type extinguishers

(2) Foam type extinguishers

(3) Dry chemical powder extinguishers

(4) Nitrogen extinguishers
82. Increase or reduction in the value of an equipment or asset is called as:

(1) Saturation  (2) Depreciation  (3) Negotiation  (4) Valuation

83. The application of human biological science along with engineering sciences for achieving the optimum level of adjustment between man and his work is known as ________.

(1) Ergonomics  (2) Economics  (3) Ecology  (4) Engineering science and Economics

84. Which are the major methods of quality control?

(1) Sampling  (2) Inspection  (3) Testing  (4) All the above

85. A process of transporting material from one place to another over a stationary structure in a continuous stream is known as ________.

(1) Transporting  (2) Hauling  (3) Conveying  (4) Hoisting

86. Which IS code is applicable for final inspection and testing?

(1) IS 14001  (2) IS 14003  (3) IS 14004  (4) IS 14000

87. Who among the following proposed the concept “Fourteen Principles of Administration”?

(1) Elton Mayo  (2) Taylor F.W.  (3) Henry Fayol  (4) None of the above

88. Total float can be expressed as:

(a) latest start time - earliest start time
(b) latest finish time - earliest finish time

Answer options:

(1) Both (a) and (b) are false  (2) (a) is true but (b) is false
(3) Both (a) and (b) are true  (4) (a) is false but (b) is true
89. What are the advantages of a good site layout or job layout?
   (1) Smooth and economical working of project.
   (2) It reduces the completion time of project.
   (3) Provides more safety on site.
   (4) All the above.

90. A method proposes a systematic strategy for reducing the system of equations to the upper triangular form using the forward elimination approach and then for obtaining values of unknowns using the back substitution process. This process is used in ________.
   (1) Gauss Elimination method  (2) Gauss Seidel method
   (3) Matrix Inversion method   (4) Method of relaxation

91. The area under the polynomial for three equal intervals (h) calculated by Simpson’s rule is ________.
   (1) \( \frac{h}{6} \{ f(x_0) + 4f(x_1) + 2f(x_2) + f(x_3) \} \)
   (2) \( \frac{h}{3} \{ f(x_0) + 4f(x_1) + 2f(x_2) + f(x_3) \} \)
   (3) \( \frac{h}{3} \{ f(x_0) + 4[f(x_1) + f(x_3)] + 2f(x_2) \} \)
   (4) \( \frac{h}{6} \{ f(x_0) + 4[f(x_1) + f(x_2)] + 2f(x_3) \} \)

92. Name the iterative method which falls under the category of Bracketing methods that start with two initial guesses that bracket the root and then systematically reduce the width of the bracket until the solution is reached.
   (1) Newton Raphson method   (2) Bisection method
   (3) Secant method            (4) Fixed point method

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P.T.O.
93. The solution of the equations,
   
   \[20x + y - 2z = 17\]
   \[3x + 20y - z = -18\]
   \[2x - 3y + 20z = 25\]
   
   by Jacobi's iteration method is:
   
   (1) 1, -1, 1  \hspace{1cm} (2) -1, -1, -1
   (3) 1, 1, 1  \hspace{1cm} (4) -1, -1, 1

94. The value of \( \int_0^6 \frac{dx}{1 + x^2} \) by using Trapezoidal rule is:
   
   (1) 1.4108  \hspace{1cm} (2) 1.3108  \hspace{1cm} (3) 1.8104  \hspace{1cm} (4) 1.0418

95. The solution for simultaneous equations by Gauss elimination method for,
   
   \[2x + 3y - z = 5\]
   \[4x + 4y - 3z = 3\]
   \[2x - 3y + 2z = 2\]
   
   is:
   
   (1) \(x = 3, y = 2, z = 1\)  \hspace{1cm} (2) \(x = 2, y = 1, z = 3\)
   (3) \(x = 1, y = 2, z = 3\)  \hspace{1cm} (4) \(x = 1, y = 3, z = 2\)

96. The real root of the equation:
   
   \[f(x) = x^3 - x - 1 = 0\]
   
   is:
   
   (1) 1.26  \hspace{1cm} (2) 1.25  \hspace{1cm} (3) 1.24  \hspace{1cm} (4) 1.23

97. What is the area of bending moment diagram of a simply supported beam subjected to triangular load of intensity 'W' kN/m at centre of span (L) and zero at both ends using Simpson's rule, assuming an equal interval of \(\frac{L}{2}\)?
   
   (1) \(\frac{WL^3}{8}\)  \hspace{1cm} (2) \(\frac{WL^3}{12}\)  \hspace{1cm} (3) \(\frac{WL^3}{16}\)  \hspace{1cm} (4) \(\frac{WL^3}{18}\)

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98. From the following table the area bounded by the curve and the $x$-axis from $x=7.47$ to $x=7.52$ is:

<table>
<thead>
<tr>
<th>$x$</th>
<th>7.47</th>
<th>7.48</th>
<th>7.49</th>
<th>7.50</th>
<th>7.51</th>
<th>7.52</th>
</tr>
</thead>
<tbody>
<tr>
<td>$y=f(x)$</td>
<td>1.93</td>
<td>1.95</td>
<td>1.98</td>
<td>2.01</td>
<td>2.03</td>
<td>2.06</td>
</tr>
</tbody>
</table>

(1) 0.09569  (2) 0.09659  (3) 0.09965  (4) 0.09865

99. The process of translating physical problem into a mathematical problem involves; making a number of simplifying assumptions, identification of important variables and postulation of relationships between variables. The process is called as:

(1) Modelling  (2) Validation  (3) Convergence  (4) Pivoting

100. If 'A' is a square matrix as given below; then adjoint of matrix A will be ________.

$$A = \begin{bmatrix} 3 & 1 & 1 \\ 1 & 3 & 1 \\ 1 & 1 & 3 \end{bmatrix}$$

(1) $\begin{bmatrix} 8 & -2 & -2 \\ 8 & -2 & -2 \\ 8 & -2 & -2 \end{bmatrix}$  (2) $\begin{bmatrix} -2 & 8 & -2 \\ 2 & 8 & 2 \\ -2 & 8 & -2 \end{bmatrix}$

(3) $\begin{bmatrix} 8 & 2 & 2 \\ 2 & 8 & 2 \\ 2 & 2 & 8 \end{bmatrix}$  (4) $\begin{bmatrix} 8 & -2 & -2 \\ -2 & 8 & -2 \\ -2 & -2 & 8 \end{bmatrix}$

- o d o -

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P.T.O.
नमुना प्रश्न

Pick out the correct word to fill in the blank :

प्र. क्र. 201.  I congratulate you __________ your grand success.

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

हा प्रश्नाचे योग्य उत्तर “(3) on” असे असेही. त्याच्या या प्रश्नाचे उत्तर “(3) on” होईल, यासाठी खालीलप्रमाणे प्रश्न प्र. क्र. 201 समोरील उत्तर-क्रमांक “(3) on” हे केल्या पूर्णपणे चार्जिकत करून दाखवणे आवश्यक आहे.

प्र. क्र. 201. ① ② ♦ ④

अशा पद्धतीने प्रस्तुत प्रश्नप्रश्नातील प्रश्नाचा तुमचा उत्तर-क्रमांक हा तुमच्या स्वतंत्रतेच्या पुढीलप्रमाणे उत्तरप्रश्नातील त्या प्रश्नक्रमांकाची संबंधित कोर्ट्या पूर्णपणे चार्जिकत करून दाखवणा. ह्यांकिता प्रश्न काळव्या शाळेचे भौतिक पायथने, पेनरता वा शाळेच्या पेन वापर नये.