परीक्षेचे नाव :- महाराष्ट्र स्थापत्य अभियांत्रिकी सेवा (मुख्य) परीक्षा - 2020

परीक्षा दि. 18 डिसेंबर, 2021

प्रश्नपुस्तिका क्रमांक
BOOKLET No.

103797

M14 संच क्र. **A**

प्रश्नपुस्तिका - I

स्थापत्य अभियांत्रिकी पेपर - 1

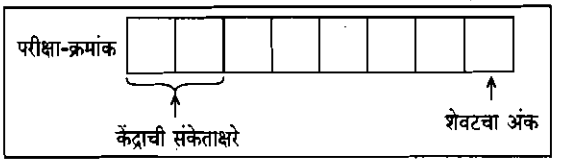
वेळ : 2 (दोन) तास

एकूण प्रश्न : 100
एकूण गुण : 200

सूचना

(1) सदर प्रश्नपुस्तिकेत **100** अनिवार्य प्रश्न आहेत. उमेदवारांनी प्रश्नांची उत्तरे लिहिण्यास सुरुवात करण्यापूर्वी या प्रश्नपुस्तिकेत सर्व प्रश्न आहेत किंवा नाहीत याची खात्री करून घ्यावी. तसेच अन्य काही दोष आढळल्यास ही प्रश्नपुस्तिका समवेक्षकांकडून लगेच बदलून घ्यावी.

(2) आपला परीक्षा-क्रमांक ह्या चौकोनांत **न विसरता बॉलपेनने** लिहावा.



(3) वर छापलेला प्रश्नपुस्तिका क्रमांक तुमच्या उत्तरपत्रिकेवर विशिष्ट जागी उत्तरपत्रिकेवरील सूचनेप्रमाणे **न विसरता नमूद करावा.**

(4) या प्रश्नपुस्तिकेतील प्रत्येक प्रश्नाला 4 पर्यायी उत्तरे सुचविली असून त्यांना 1, 2, 3 आणि 4 असे क्रमांक दिलेले आहेत. त्या चार उत्तरांपैकी सर्वात योग्य उत्तराचा क्रमांक उत्तरपत्रिकेवरील सूचनेप्रमाणे तुमच्या उत्तरपत्रिकेवर नमूद करावा. अशा प्रकारे उत्तरपत्रिकेवर उत्तरक्रमांक नमूद करताना तो संबंधित प्रश्नक्रमांकासमोर छायांकित करून दर्शविला जाईल याची काळजी घ्यावी. **ह्याकरिता फक्त काळ्या शाईचे बॉलपेन वापरावे, पेन्सिल वा शाईचे पेन वापरू नये.**

(5) सर्व प्रश्नांना समान गुण आहेत. यास्तव सर्व प्रश्नांची उत्तरे द्यावीत. घाईमुळे चुका होणार नाहीत याची दक्षता घेऊनच शक्य तितक्या वेगाने प्रश्न सोडवावेत. क्रमाने प्रश्न सोडविणे श्रेयस्कर आहे पण **एखादा प्रश्न कठीण वाटल्यास त्यावर वेळ न घालविता पुढील प्रश्नाकडे वळावे.** अशा प्रकारे शेवटच्या प्रश्नापर्यंत पोहोचल्यानंतर वेळ शिल्लक राहिल्यास कठीण म्हणून वगळलेल्या प्रश्नांकडे परतणे सोईस्कर ठरेल.

(6) उत्तरपत्रिकेत एकदा नमूद केलेले उत्तर खोडता येणार नाही. नमूद केलेले उत्तर खोडून नव्याने उत्तर दिल्यास ते तपासले जाणार नाही. एकापेक्षा जास्त उत्तरे नमूद केल्यास ते उत्तर चुकीचे धरले जाईल व त्या चुकीच्या उत्तराचे गुण वजा केले जातील.

(7) **प्रस्तुत परीक्षेच्या उत्तरपत्रिकांचे मूल्यांकन करताना उमेदवाराच्या उत्तरपत्रिकेतील योग्य उत्तरांनाच गुण दिले जातील. तसेच "उमेदवाराने वस्तुनिष्ठ बहुपर्यायी स्वरूपाच्या प्रश्नांची दिलेल्या चार उत्तरांपैकी सर्वात योग्य उत्तरेच उत्तरपत्रिकेत नमूद करावीत. अन्यथा त्यांच्या उत्तरपत्रिकेत सोडविलेल्या प्रत्येक चुकीच्या उत्तरांसाठी 25% किंवा 1/4 गुण वजा करण्यात येतील".**

ताकीद

ह्या प्रश्नपत्रिकेसाठी आयोगाने विहित केलेली वेळ संपेपर्यंत ही प्रश्नपुस्तिका आयोगाची मालमत्ता असून ती परीक्षाकक्षात उमेदवाराला परीक्षेसाठी वापरण्यास देण्यात येत आहे. ही वेळ संपेपर्यंत सदर प्रश्नपुस्तिकेची प्रत/प्रती, किंवा सदर प्रश्नपुस्तिकेतील काही आशय कोणत्याही स्वरूपात प्रत्यक्ष वा अप्रत्यक्षपणे कोणत्याही व्यक्तीस पुरविणे, तसेच प्रसिद्ध करणे हा गुन्हा असून अशी कृती करणाऱ्या व्यक्तीवर शासनाने जारी केलेल्या "परीक्षांमध्ये होणाऱ्या गैरप्रकारांना प्रतिबंध करण्याबाबतचा अधिनियम-82" यातील तरतुदीनुसार तसेच प्रचलित कायद्याच्या तरतुदीनुसार कारवाई करण्यात येईल व दोषी व्यक्ती कमाल एक वर्षाच्या कारावासाच्या आणि/किंवा रुपये एक हजार रकमेच्या दंडाच्या शिक्षेस पात्र होईल.

तसेच ह्या प्रश्नपत्रिकेसाठी विहित केलेली वेळ संपण्याआधी ही प्रश्नपुस्तिका अनधिकृतपणे बाळगणे हा सुद्धा गुन्हा असून तसे करणारी व्यक्ती आयोगाच्या कर्मचारीवृंदापैकी, तसेच परीक्षेच्या पर्यवेक्षकीयवृंदापैकी असली तरीही अशा व्यक्तीविरुद्ध उक्त अधिनियमानुसार कारवाई करण्यात येईल व दोषी व्यक्ती शिक्षेस पात्र होईल.

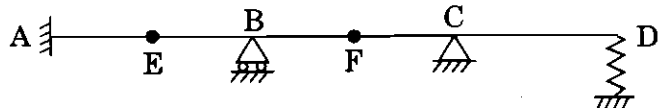
पुढील सूचना प्रश्नपुस्तिकेच्या अंतिम पृष्ठावर पहा

पर्यवेक्षकांच्या सूचनेविना हे सील उघडू नये

SEAL SEAL

कच्च्या कामासाठी जागा/SPACE FOR ROUGH WORK

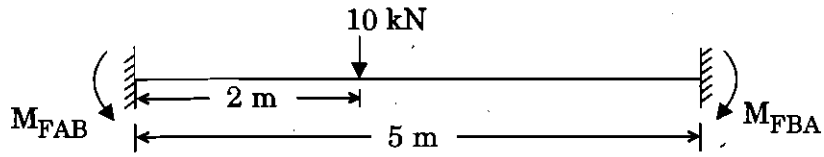
1. The kinematic indeterminacy of the following beam after imposing the boundary conditions is



(1) 6 (2) 8 (3) 10 (4) 12

---

2. A fixed beam AB, of constant EI, shown in figure below, supports a concentrated load of 10 KN. What is the fixed end-moment M_{FAB} at support A ?



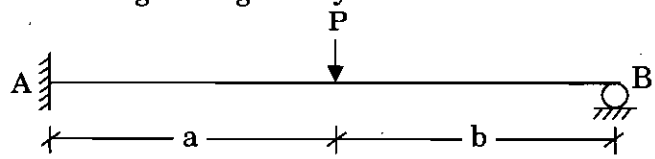
(1) 4·8 KN.m (2) 6·0 KN.m (3) 7·2 KN.m (4) 9·5 KN.m

---

3. Consider the following statements :
Sinking of an intermediate support of a continuous beam
(i) Reduces the negative moment at support.
(ii) Increases the negative moment at support.
(iii) Reduces the positive moment at the centre of span.
(iv) Increases the positive moment at the centre of span.
Out of these above statements :
(1) (i) and (iv) are correct (2) (i) and (iii) are correct
(3) (ii) and (iii) are correct (4) (ii) and (iv) are correct

---

4. Fixed end of propped cantilever due to a concentrated load P at a distance 'a' from fixed ends as shown in figure is given by



(1) $\frac{Pab\,(L+b)}{2L^2}$ (2) $\frac{Pab\,(L+b)}{L^2}$

(3) $\frac{-Pab\,(L+b)}{2L^2}$ (4) $\frac{-Pab\,(L+a)}{L^2}$

---

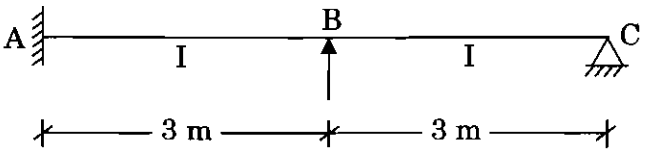
5. The sinking moment in a prismatic fixed beam whose one support yields by δ will be where, l is length of beam

I is Moment of Inertia

E is Modulus of Elasticity

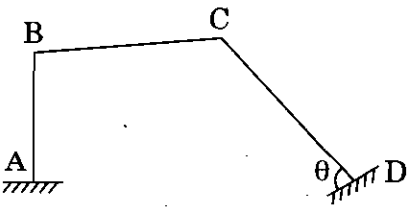
(1) $\frac{2\,EI\,\delta}{l}$ (2) $\frac{4\,EI\,\delta}{l}$ (3) $\frac{6\,EI\,\delta}{l^2}$ (4) $\frac{6\,EI\,\delta}{l}$

6. The distribution factor for BA member in the given figure is



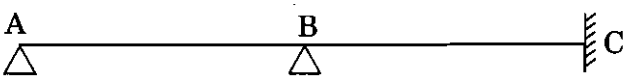
(1) $\frac{1}{12}$ (2) $\frac{4}{7}$ (3) $\frac{3}{7}$ (4) $\frac{1}{2}$

7. In the frame shown in the figure, if lateral sway of BC is Δ, the sway in member DC is



(1) Δ (2) $\Delta \cos\theta$ (3) $\Delta \sin\theta$ (4) $\Delta \sec\theta$

8. Pick up the correct option from the following for the beam as shown in the figure



a. $M_{AB} = 0$ b. $M_{AB} = M_{BA}$

c. $M_{BA} + M_{BC} = 0$ d. $M_{CB} = 0$

(1) a and c are correct (2) b and c are correct

(3) only d is correct (4) only c is correct

9. If the far end of the beam is fixed, the stiffness of beam with usual notations is

(1) $\frac{2\,EI}{L}$ (2) $\frac{4\,EI}{L}$

(3) $\frac{3\,EI}{L}$ (4) $\frac{4\,EI}{L^2}$

---

10. If three members meet at a joint and the stiffness of members are $K_1 = EI$, $K_2 = 2\,EI$, $K_3 = 1{\cdot}5\,EI$, the distribution factor for member 1 is

(1) $\frac{1}{3}$ (2) $\frac{2}{7}$ (3) $\frac{2}{9}$ (4) None of the above

---

11. Pick up the correct statement that corresponds to moment distributions method.

(i) Unbalanced moment is carried over to the other end of the member when the joint is released.

(ii) Carry over moment has same sign as the distribution end moments.

(1) Both (i) and (ii) are correct

(2) Only (i) is correct

(3) Only (ii) is correct

(4) Both (i) and (ii) are incorrect

---

12. If the central rise of a symmetrical parabolic arch is 10 m, then the rise of the arch at quarter point is

(1) 2·5 m (2) 5·0 m

(3) 7·5 m (4) 8·0 m

---

13. When a 3-hinged semi-circular arch is subjected to uniformly distributed load on entire span, the nature of bending moment at any section is

(1) Sagging only

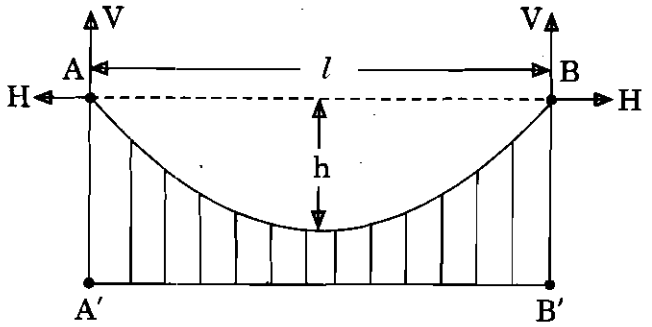
(2) Hogging only

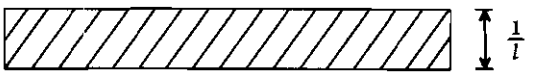
(3) Zero

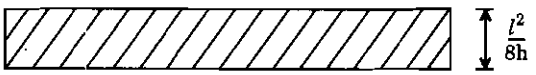
(4) Partially Sagging & Partially Hogging

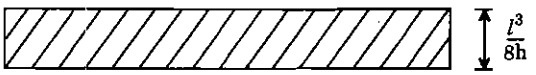
---

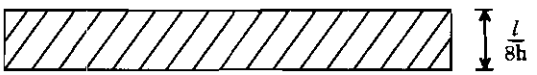
14. For suspension cable with two-hinged stiffening girder as shown in figure, the influence diagram for horizontal thrust is



(1) 

(2) 

(3) 

(4) 

15. The net horizontal force (F_H) on the top of this tower and the bending moment (B.M.) at the base of the tower due to cable reaction is

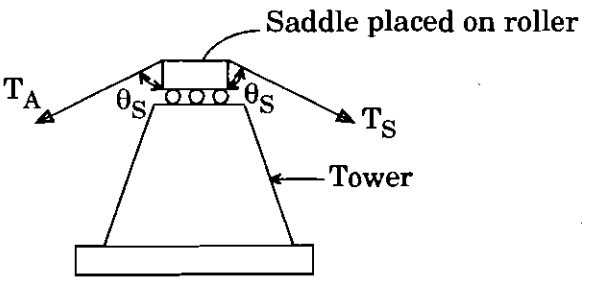


Figure : Roller support

Answer options :

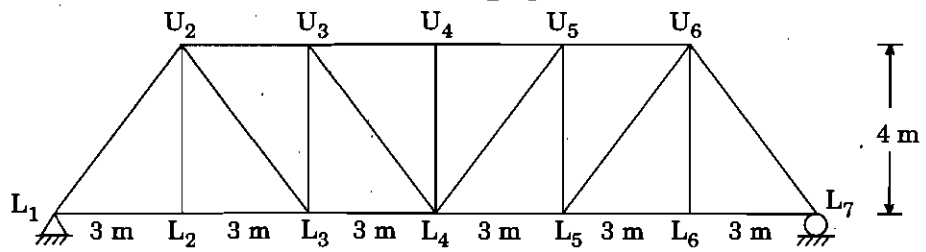
(1) $F_H = T_A \cos\theta$, B.M. $= T_A \sin\theta$

(2) $F_H = T_S \cos\theta$, B.M. = Zero

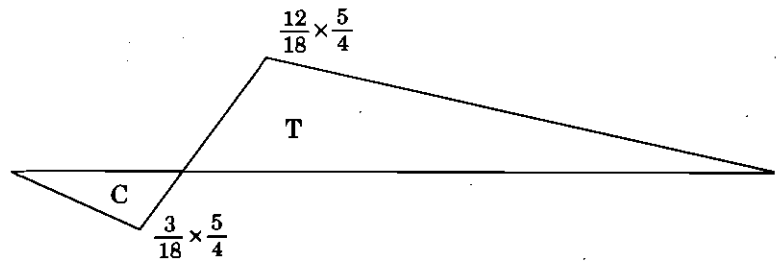
(3) F_H = Zero, B.M. $= T_A \sin\theta - T_A \cos\theta$

(4) F_H = Zero, B.M. = Zero

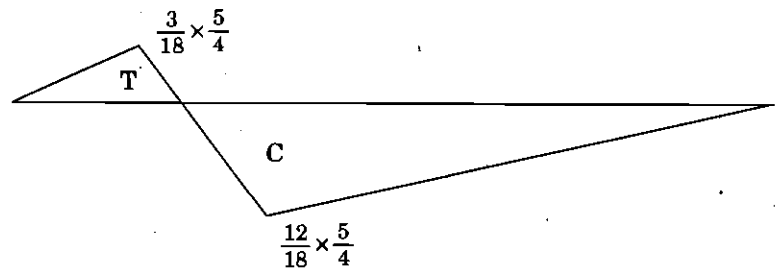
16. A truss of panel dimensions 3 × n × 4 m is as shown in figure. The influence line diagram for the force in the member $U_2 L_3$ is



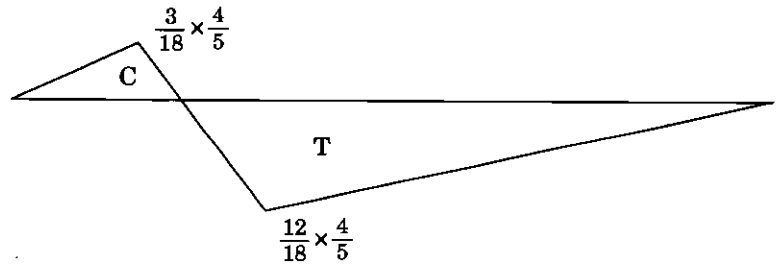
(1)



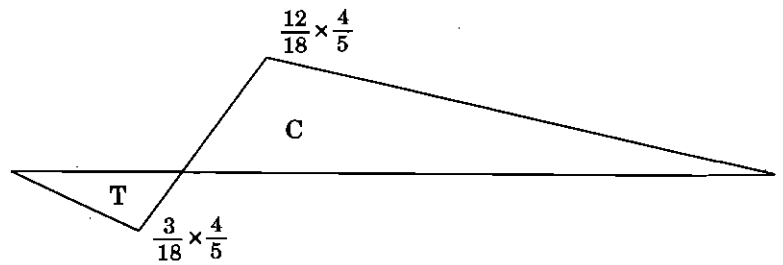
(2)



(3)



(4)

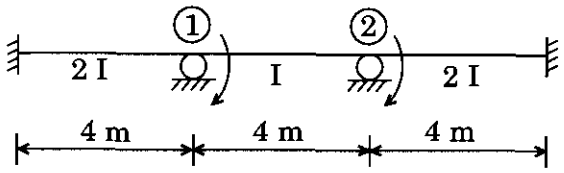


17. Which principle can be used to obtain the general shape of the influence lines ?

(1) Bernoulli – Euler's Principle (2) Muller – Breslau's Principle

(3) Stokes' Principle (4) D'Alembert's Principle

18. The co-ordinates for a beam are shown in figure. Stiffness matrix is given by



(1) $\begin{bmatrix} 3EI & EI \\ EI & 2EI \end{bmatrix}$ (2) $\begin{bmatrix} 3EI & -0{\cdot}5EI \\ -0{\cdot}5EI & 2EI \end{bmatrix}$

(3) $\begin{bmatrix} 3EI & 0 \\ 0 & 2EI \end{bmatrix}$ (4) $\begin{bmatrix} 3EI & 0{\cdot}5EI \\ 0{\cdot}5EI & 2EI \end{bmatrix}$

19. For a prismatic beam element, if the stiffness matrix is $\frac{2EI}{L}\begin{bmatrix} 2 & 1 \\ 1 & 2 \end{bmatrix}$, then the flexibility matrix is

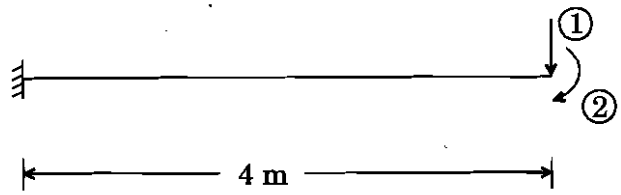
(1) $\frac{L}{2EI}\begin{bmatrix} 0{\cdot}5 & 1 \\ 1 & 0{\cdot}5 \end{bmatrix}$

(2) $\frac{L}{6EI}\begin{bmatrix} 1 & -2 \\ -2 & 1 \end{bmatrix}$

(3) $\frac{L}{6EI}\begin{bmatrix} 2 & -1 \\ -1 & 2 \end{bmatrix}$

(4) $\frac{L}{3EI}\begin{bmatrix} 2 & -1 \\ -1 & 2 \end{bmatrix}$

20. The flexibility matrix of the beam shown below is _____ .



(1) $\begin{bmatrix} \frac{64}{3EI} & \frac{-8}{EI} \\ \frac{-8}{EI} & \frac{64}{3EI} \end{bmatrix}$

(2) $\begin{bmatrix} \frac{64}{3EI} & \frac{8}{EI} \\ \frac{8}{EI} & \frac{16}{EI} \end{bmatrix}$

(3) $\begin{bmatrix} \frac{64}{3EI} & \frac{-8}{EI} \\ \frac{-8}{EI} & \frac{4}{EI} \end{bmatrix}$

(4) $\begin{bmatrix} \frac{64}{3EI} & \frac{8}{EI} \\ \frac{8}{EI} & \frac{4}{EI} \end{bmatrix}$

---

21. For stable structures, one of the important properties of flexibility and stiffness matrices is that the element on the main diagonal

(i) of a stiffness matrix must be negative.

(ii) of a stiffness matrix must be positive.

(iii) of a flexibility matrix must be positive.

(iv) of a flexibility matrix must be negative.

Answer options :

(1) (i) and (iii)

(2) (i) and (iv)

(3) (ii) and (iii)

(4) (ii) and (iv)

---

22. Flexibility matrix method of analysis is basically

(1) Force method

(2) Displacement method

(3) Equilibrium method

(4) None of the above

---

23. The angle of dispersion of load in web buckling of beam is

(1) 30° (2) 33° (3) 40° (4) 45°

24. In case of unequal angle section oriented with longer leg vertical, axis parallel to shorter leg of the angle and passing from centroid of cross section is _____ .

(1) x – x axis (2) y – y axis

(3) z – z axis (4) u – u axis

25. Two steel plates of 100 mm width each, are lap jointed. If length of lap is 200 mm, the maximum number of 20 mm diameter bolts that can be provided for connection are _____ .

(1) one (2) two (3) three (4) four

26. Design of pins is primarily governed by

(1) Shear (2) Bearing (3) Flexure (4) All of the above

27. Slope of a truss is equal to

(1) pitch/2 (2) pitch (3) 2 times pitch (4) 1·5 times pitch

28. In columns, splices should be provided at

(1) the floor levels (2) the mid height of columns

(3) the beam-column joints (4) $\frac{1}{4}^{th}$ height of columns

29. The imperfection factor for welded steel section is

(1) 0·21 (2) 0·35 (3) 0·42 (4) 0·49

30. What is the efficiency of joint when strength of bolt per pitch length is 60 kN and strength of plate per pitch length is 150 kN ?

(1) 25% (2) 30% (3) 35% (4) 40%

31. A bolted joint may experience

(1) shear failure

(2) shear failure of plates

(3) bearing failure and bearing failure of bolts

(4) All of the above

32. The partial safety factor for the material of bolt is

(1) 1·0 (2) 1·10 (3) 1·15 (4) 1·25

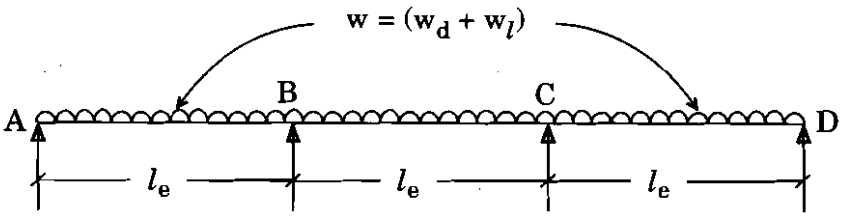
---

33. Lacing shall be designed to resist a total transverse shear equal to _____ of axial force in member.

(1) 5% (2) 1% (3) 4·3% (4) 2·5%

---

34. A continuous beam ABCD as shown in figure is subjected to U.D.L., 'w' kN/m over all spans. What is the moment at support 'C' due to Dead Load (w_d) and Live Load (w_l) as per IS 456-2000 ?



(1) $-\left(\frac{w_d \cdot l_e^2}{10} + \frac{w_l \cdot l_e^2}{9}\right)$ (2) $-\left(\frac{w_d \cdot l_e^2}{12} + \frac{w_l \cdot l_e^2}{10}\right)$

(3) $-\left(\frac{w_d \cdot l_e^2}{12} + \frac{w_l \cdot l_e^2}{9}\right)$ (4) $-\left(\frac{w_d \cdot l_e^2}{16} + \frac{w_l \cdot l_e^2}{12}\right)$

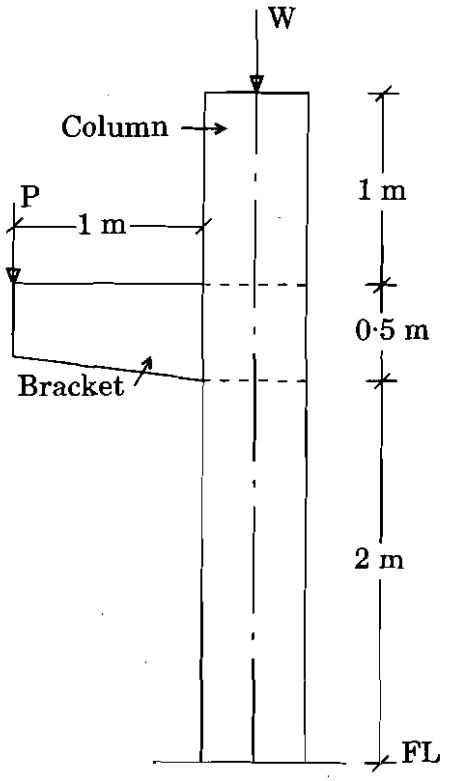
---

35. For two-way continuous slab of shorter span ≤ 3·5 m with HYSD reinforcement, the span to overall depth ratio is taken as _____ to satisfy the vertical deflection limit for loading class up to 3 kN/m^2.

(1) 26 (2) 28 (3) 32 (4) 35

---

36. What is the unsupported length of the column as shown in figure, if c/s of column is 300 mm × 500 mm and c/s of bracket is 300 mm × 500 mm ?



(1) 3·5 m (2) 3·0 m (3) 2·5 m (4) 2·0 m

---

37. A beam is designed using M20 grade of concrete and Fe415 grade of steel is used for tension reinforcement. If diameter of main steel is 12 mm, then what is the minimum value of development length (L_d) provided in support section ?

(1) 470 mm (2) 564 mm (3) 260 mm (4) 300 mm

---

38. The basic maximum ratio of span to effective depth of a slab simply supported and spanning in one direction is _____ for spans up to 10 m.

(1) 35 (2) 25 (3) 30 (4) 20

---

39. The horizontal distance between parallel reinforcement bars or groups, near the tension face of a beam shall not be _____ if Fe415 grade of steel is used as reinforcement without redistribution of moments.

(1) 125 mm (2) 150 mm

(3) 165 mm (4) 180 mm

---

40. The thickness at the edge of footing shall be not less than _____ for footing on soil nor less than _____ above the top of the piles for footing on piles.

(1) 100 mm, 150 mm (2) 125 mm, 200 mm

(3) 150 mm, 300 mm (4) 150 mm, 150 mm

41. In case of stairs with open wells, where spans partly crossing at right angles occur, the load on area common to any two such spans may be taken as _____ in each direction.

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

42. A circular water tank is designed to store water for 78,500 litres capacity. The water tank rests on ground with flexible joints. If M30 concrete and Fe415 steel is used, then what is the maximum hoop tension developed in water tank, if diameter and total height of tank are 5 m and 4 m respectively ?

(1) 200 kN (2) 150 kN (3) 100 kN (4) 50 kN

43. Cantilever retaining wall is designed mainly to resist _____ from backfill.

(1) Active earth pressure

(2) Passive earth pressure

(3) Uplift earth pressure

(4) Water pressure

44. If the thickness of the slab is 160 mm, then what will be the maximum diameter of reinforcing bars that can be used as main reinforcement ?

(1) 10 mm (2) 12 mm

(3) 16 mm (4) 20 mm

45. The frictional and anchorage slip losses are observed in

(1) Post-tensioned members (2) Pre-tensioned members

(3) Ruptured members (4) Tensile members

---

46. A simply supported prestressed concrete beam of c/s 150 mm × 250 mm is subjected to a superimposed load of 5 kN/m over a span of 5 m. If the prestressing force of 750 kN is applied through parabolic cable with eccentricity of 50 mm at centre and zero eccentricity at support, then what will be the extreme fibre stress at bottom fibre at end support ? (Neglect the self-weight)

(1) 20 MPa (2) 23·68 MPa (3) 16·31 MPa (4) 26 MPa

---

47. In reference to limit state of serviceability cracking, when cracking is permitted and hypothetical tensile stresses are considered in design assuming section is uncracked, it is _____ .

(1) Type-1 element (2) Type-2 element

(3) Type-3 element (4) Type-4 element

---

48. In the case of high tensile alloy steel bars, any straightening shall be carried out by mechanical means. Bars shall not be bent when their temperature is less than _____.

(1) 10° (2) 20° (3) 5° (4) 15°

---

49. A post-tensioned prestressed concrete beam is stressed by three cables, each with c/s area of 50 mm^2 with an initial stress of 900 MPa. If all three cables are straight and located at an eccentricity of 50 mm, consider modular ratio (m) = 6 and stress in concrete at the level of steel (f_c) = 5 MPa, then what will be the loss in stress in cables due to elastic shortening if all cables are simultaneously tensioning and anchoring ?

(1) 90 MPa (2) 60 MPa (3) 30 MPa (4) 0

---

50. A rectangular concrete beam 120 × 300 mm is prestressed by straight cable, effective force 180 kN at eccentricity e = 50, area 36×10^3 mm^2, $z = 18 \times 10^3$ mm^3. Find total stress due to prestress.

(1) 10 (2) 25 (3) 35 (4) 45

---

51. The minimum 28-day cube compressive strength prescribed in the Indian Standard Code IS 1343 for pre-tensioned member is _____ .

(1) 30 N/mm^2 (2) 35 N/mm^2 (3) 40 N/mm^2 (4) 45 N/mm^2

---

52. At the time of initial tensioning, the maximum tensile stress, f_{pi} immediately behind the anchorage shall not exceed _____ of the ultimate tensile strength, f_{pu} of the wire or bar or strand.

(1) 46% (2) 67% (3) 76% (4) 87%

53. Minimum strength of concrete at transfer stage shall be _____

(1) $0{\cdot}5\ f_{ck}$ (2) $0{\cdot}24\ \sqrt{f_{ck}}$ (3) $0{\cdot}67\ f_{ck}$ (4) $0{\cdot}7\ \sqrt{f_{ck}}$

54. Drying shrinkage strain develops slowly, as it _____ .

(1) develops during initial period of concreting

(2) depends on time

(3) develops due to prestressing of concrete

(4) is a function of migration of water through the hardened concrete

55. In the case of cables or large bars, the minimum clear spacing measured between sheathings/ducts shall not be less than the larger of _____ .

(1) 30 mm or 3 times diameter of cables.

(2) 40 mm or maximum size of cables or bar or nominal maximum size of aggregate plus 5 mm.

(3) 50 mm or 3 times diameter of cables or nominal maximum size of aggregate plus 5 mm.

(4) 60 mm or 2 times diameter of cables or nominal maximum size of aggregate plus 5 mm.

56. Which IS code describes detailed precautions regarding safety measures for drilling and blasting operations ?

(1) IS 1456 – 2004 (2) IS 481 – 1967

(3) IS 2023 – 1985 (4) IS 4081 – 1986

57. When events of a bigger network are numbered as 10, 20, 30, 40, etc., what is the process of numbering called ?

(1) Skip Numbering (2) Special Numbering

(3) Prime Numbering (4) Ultimate Numbering

58. What is optimistic time estimate considered in PERT analysis ?

(1) Maximum possible time (2) Shortest possible time

(3) Most likely time (4) None of the above

59. In Quality Control, Reliability, for sampling of units, is expressed as a percentage in the form of a Reliability number as

(1) $100 - \left[\frac{\text{no. of defective units}}{\text{no. of units tested}} \times 100\right]$

(2) $100 - \left[\frac{\text{no. of units tested}}{\text{no. of defective units}} \times 100\right]$

(3) $100 - \left[\frac{\text{no. of units tested}}{\text{no. of defective units}} \times \text{standard deviation}\right]$

(4) $100 - [\text{no. of possible defective units}]$

---

60. Identify which of the following inventory control policy is classified *on the basis of consumption rate of inventory* and helps to control obsolescence ?

(1) SDE (Scarce, Difficult and Easy)

(2) VED (Vital, Essential and Desirable)

(3) HML (High, Medium and Low)

(4) FSN (Fast, Slow and Normal)

---

61. In construction industry, the conformance cost associated with preparing work instructions and checklist, drafting specifications, training of staff and workmen is classified as

(1) Prevention Cost (2) Appraisal Cost

(3) Failure Cost (4) Inventory Cost

---

62. Which among the following are the principles which belong to modern management theory suggested by Henry Fayol ?

(i) Obtaining harmony in group action

(ii) Replacing rules of thumb with science

(iii) Authority and Responsibility

(iv) Unity of command

Answer options :

(1) Only (i), (ii) and (iii) (2) Only (i), (iii) and (iv)

(3) Only (i) and (iii) (4) Only (iii) and (iv)

---

63. Which of the following statements are true for line-type organization ?

(i) These are easier to establish.

(ii) There is no unity of control.

(iii) Decisions can be taken quickly.

(iv) There is a strong sense of discipline.

Answer options :

(1) All of the above

(2) Only (i), (iii) and (iv)

(3) Only (i), (ii) and (iv)

(4) Only (i)

---

64. Which type of crane will you recommend for the construction of High Rise Building ?

(1) Crawler crane

(2) Truck mounted crane

(3) Tower crane

(4) Gantry crane

---

65. The occupational disease that results from the inhalation of specific dust to the construction worker is

(1) Bursitis

(2) Hearing impairment

(3) Muscle disorder

(4) Pneumoconiosis

---

66. In quality management system, the set of activities which builds confidence of both customers and managers and suggests that all quality requirements are being met is called as

(1) Quality of concept

(2) Design quality

(3) Quality control

(4) Quality assurance

---

67. In solving simultaneous equations by Gauss-Jordan method, the coefficient matrix is reduced to _____ matrix.

(1) Square (2) Diagonal

(3) Null (4) Triangular

---

68. Using Gauss-Jordan method, the solution of the system of equations

$x + y + z = 9$

$2x - 3y + 4z = 13$

$3x + 4y + 5z = 40$

is

(1) $x = 3, y = 1, z = 5$ (2) $x = 5, y = 1, z = 3$

(3) $x = 9, y = 1, z = \frac{13}{2}$ (4) $x = 1, y = 3, z = 5$

---

69. Solve the following equations by Gauss elimination method.

$2x + 4y - 6z = -4$

$x + 5y + 3z = 10$

$x + 3y + 2z = 5$

(1) $x = -3, y = 2, z = 1$ (2) $x = 3, y = -2, z = 1$

(3) $x = 3, y = 1, z = -2$ (4) $x = 1, y = 3, z = -2$

---

70. Apply Gauss elimination method to solve the following equations.

$x + 4y - z = -5$

$x + y - 6z = -12$

$3x - y - z = 4$

(1) $x = 1{\cdot}6479, y = -1{\cdot}1408, z = 2{\cdot}0845$

(2) $x = -2{\cdot}1155, y = 0{\cdot}1555, z = 1{\cdot}5835$

(3) $x = 3{\cdot}8425, y = -2{\cdot}2835, z = 0{\cdot}8455$

(4) $x = -2{\cdot}2885, y = 1{\cdot}4825, z = 3{\cdot}7885$

---

71. While solving the following simultaneous equations by iterative methods, with $x_1 = 0$, $x_2 = 0$ and $x_3 = 0$,

$20x_1 + 2x_2 + 6x_3 = 28$

$x_1 + 20x_2 + 9x_3 = -23$

$2x_1 - 7x_2 - 20x_3 = -57$

what will be the value of x_1 in next iteration ?

(1) 1·0 (2) 1·20 (3) 1·33 (4) 1·40

---

72. Obtain root of equation $f(x) = \cos x - xe^x = 0$ using bisection method.

(1) 0·515 (2) 0·425 (3) 0·325 (4) 0·715

---

73. The root of the equation using $x \log_{10} x = 1{\cdot}2$, using Newton-Raphson method by assuming initial approximation as 2 is

(1) 2·513 (2) 2·0256 (3) 2·169 (4) 2·741

---

74. Find the smallest positive root of the equation $3x^3 - 9x^2 + 8 = 0$, correct to 4 places of decimals using Newton-Raphson method.

(1) 3·2568 (2) 1·2261 (3) 2·2361 (4) 0·8261

---

75. Evaluate $\int_0^6 \frac{dx}{1+x^2}$ by using Simpson's $\frac{3}{8}$ rule. (Choose step size h = 1)

(1) 1·4326 (2) 3·1571 (3) 4·132 (4) 1·3571

---

76. The number of strips required in Simpson's $\frac{3}{8}$ rule is a multiple of

(1) 1 (2) 2 (3) 3 (4) 6

---

77. Evaluate the integral $I = \int_3^7 x^2 \cdot \log x \cdot dx$, using Simpson's $\frac{1}{3}$ rule with h = 1.

(1) 277·4216 (2) 177·4816

(3) 127·6251 (4) 150·6626

---

78. As a part of ground work for plaster, dots are laid on the surface of wall to be plastered having size

(1) 10 cm × 10 cm (2) 20 cm × 20 cm

(3) 10 mm × 10 mm (4) 15 cm × 15 cm

79. A vertical member of a frame which is employed to sub-divide a window or door vertically is called as

(1) Jamb (2) Reveal

(3) Transom (4) Mullion

80. Following paint hardens by evaporation of thinner or solvent :

(1) Aluminium paint (2) Cellulose paint

(3) Asbestos paint (4) Silicate paint

81. A pneumatic caisson is a structure used in foundation work, which is

(1) Open at top as well as bottom

(2) Open at bottom and closed at top

(3) Closed at top as well as bottom

(4) Closed at bottom and open at top

82. By using which materials can resilient floors be made ?

(1) PVC (2) Rubber

(3) Linoleum (4) All of the above

83. In which IS code are details of slump test mentioned ?

(1) IS 1060 – 1968 (2) IS 1199 – 1999

(3) IS 1280 – 2000 (4) IS 1357 – 1998

84. Which defect in timber is an early sign of decay ?

(1) Heart Shake (2) Star Shake

(3) Ring Shake (4) Cup Shake

85. Normally what should be the height of building for which fire lifts must be provided ?

(1) Above 15 meters (2) Above 25 meters

(3) Above 40 meters (4) Above 50 meters

86. As per IS 456 – 2000, minimum cement content for M25 grade concrete with moderate exposure condition used in R.C.C. work is

(1) 250 kg/m^3 (2) 300 kg/m^3 (3) 320 kg/m^3 (4) 340 kg/m^3

87. The water seal in the traps varies from

(1) 5 to 10 cm (2) 3·5 to 7·5 cm (3) 2·5 to 5·0 cm (4) 3·0 to 7·5 cm

88. Specific gravity of building stones should be more than

(1) 2·7 (2) 2·9 (3) 3·0 (4) 2·5

89. If _____ constituent is in excess in brick earth it makes bricks brittle.

(1) Alumina (2) Silica

(3) Lime (4) Magnesia

90. When a body is subjected to the two mutually perpendicular stresses, σ_x & σ_y, then the centre of Mohr's circle from the origin is

(1) $\frac{\sigma_x + \sigma_y}{2}$ (2) $\frac{\sigma_x - \sigma_y}{2}$ (3) $\frac{2\sigma_x + \sigma_y}{2}$ (4) $\sigma_x + \sigma_y$

91. What will be the modulus of rigidity, if the value of modulus of elasticity is 200 KN/mm^2 & Poisson Ratio is 0·25 ?

(1) 70 (2) 80 (3) 125 (4) 200

---

92. Due to external loading, the length of member is decreased by dl. The ratio of decrease in length to original length is called

(1) Intensity of stress (2) Compressive stress

(3) Shear strain (4) Compressive strain

---

93. A simply supported beam of span 'L' m is carrying a triangular load, varying gradually from zero at supports (i.e. both ends) to W per unit length at the centre of span. What will be the maximum bending moment ?

(1) $\frac{WL^2}{6}$ (2) $\frac{WL^2}{12}$ (3) $\frac{3WL^2}{20}$ (4) $\frac{2WL^2}{9}$

---

94. The bending equation is written as _____ .

(1) $\frac{I}{M} = \frac{\sigma}{Y} = \frac{E}{R}$ (2) $\frac{M}{I} = \frac{\sigma^2}{Y} = \frac{E^2}{R^2}$

(3) $\frac{M}{I} = \frac{\sigma}{Y} = \frac{E}{R}$ (4) $\frac{M^2}{I} = \frac{\sigma^2}{Y} = \frac{E^2}{R}$

---

95. If a point in a strained material is subjected to two mutually perpendicular stresses, σ_x = 100 MPa (T) and σ_y = 50 MPa (C), then what will be the magnitude of maximum shear stress ?

(1) 25 MPa (2) 50 MPa (3) 75 MPa (4) 150 MPa

---

96. A bar of diameter 30 mm is subjected to a tensile load such that the measured extension on a gauge length of 200 mm is 0·09 mm and the change in diameter is 0·0045 mm. Calculate the Poisson Ratio :

(1) $\frac{1}{3}$ (2) $\frac{1}{4}$ (3) $\frac{1}{5}$ (4) $\frac{1}{6}$

---

97. A point of contraflexure in a bending moment diagram indicates _____.

(1) Negative Bending moment

(2) Zero shear force

(3) Bending moment changes sign

(4) Shear force changes sign

---

98. A simply supported beam of span l is carrying point load W at mid span. What is the deflection at centre of beam ?

(1) $\frac{Wl^2}{48EI}$ (2) $\frac{Wl^3}{48EI}$

(3) $\frac{5}{348}\frac{Wl^3}{EI}$ (4) $\frac{11}{120}\frac{Wl^3}{EI}$

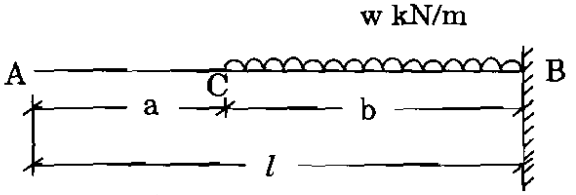
---

99. The section modulus of a circular section at an axis passing its CG is

(1) $\frac{\pi d^2}{4}$ (2) $\frac{\pi d^2}{16}$ (3) $\frac{\pi d^3}{16}$ (4) $\frac{\pi d^3}{32}$

---

100. A cantilever beam AB of length 'l' and subjected to a U.D.L. of intensity 'w' kN/m over a length 'b' is shown in the figure. If EI is constant, then what is the deflection at C ?



(1) $\frac{w \cdot a \cdot b^3}{6\,EI}$ (2) $\frac{w \cdot b^3}{6\,EI}$

(3) $\frac{w \cdot a \cdot b^3}{8\,EI}$ (4) $\frac{w \cdot b^4}{8\,EI}$

सूचना — (पृष्ठ 1 वरून पुढे.....)

(8) प्रश्नपुस्तिकेमध्ये विहित केलेल्या विशिष्ट जागीच कच्चे काम (रफ वर्क) करावे. प्रश्नपुस्तिकेव्यतिरिक्त उत्तरपत्रिकेवर वा इतर कागदावर कच्चे काम केल्यास ते कॉपी करण्याच्या उद्देशाने केले आहे, असे मानले जाईल व त्यानुसार उमेदवारावर शासनाने जारी केलेल्या "परीक्षांमध्ये होणाऱ्या गैरप्रकारांना प्रतिबंध करण्याबाबतचे अधिनियम-82" यातील तरतुदीनुसार कारवाई करण्यात येईल व दोषी व्यक्ती कमाल एक वर्षाच्या कारावासाच्या आणि/किंवा रुपये एक हजार रकमेच्या दंडाच्या शिक्षेस पात्र होईल.

(9) सदर प्रश्नपत्रिकेसाठी आयोगाने विहित केलेली वेळ संपल्यानंतर उमेदवाराला ही प्रश्नपुस्तिका स्वत:बरोबर परीक्षाकक्षाबाहेर घेऊन जाण्यास परवानगी आहे. **मात्र परीक्षाकक्षाबाहेर जाण्यापूर्वी उमेदवाराने आपल्या उत्तरपत्रिकेचा भाग-1 समवेक्षकाकडे न विसरता परत करणे आवश्यक आहे.**

नमुना प्रश्न

Pick out the correct word to fill in the the blank :

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

(1) for (2) at

(3) on (4) about

ह्या प्रश्नाचे योग्य उत्तर "(3) on" असे आहे. त्यामुळे या प्रश्नाचे उत्तर "(3)" होईल. यास्तव खालीलप्रमाणे प्रश्न क्र. **201** समोरील उत्तर-क्रमांक "③" हे वर्तुळ पूर्णपणे छायांकित करून दाखविणे आवश्यक आहे.

प्र. क्र. **201.** ① ② ● ④

अशा पद्धतीने प्रस्तुत प्रश्नपुस्तिकेतील प्रत्येक प्रश्नाचा तुमचा उत्तर-क्रमांक हा तुम्हाला स्वतंत्ररीत्या पुरविलेल्या उत्तरपत्रिकेवरील त्या त्या प्रश्नक्रमांकासमोरील संबंधित वर्तुळ पूर्णपणे छायांकित करून दाखवावा. **ह्याकरिता फक्त काळ्या शाईचे बॉलपेन वापरावे, पेन्सिल वा शाईचे पेन वापरू नये.**

कच्च्या कामासाठी जागा / SPACE FOR ROUGH WORK

कच्च्या कामासाठी जागा / SPACE FOR ROUGH WORK