महाराष्ट्र अभियांत्रिकी सेवा (स्थापत्य) (मुख्य) परीक्षा-2018
परीक्षा दिनांक - 25/11/2018

प्रश्नपुस्तिका क्रमांक
BOOKLET No.

102933

2018

प्रश्नपुस्तिका-I **K12** संच क्र. **A**

स्थापत्य अभियांत्रिकी पेपर – 1

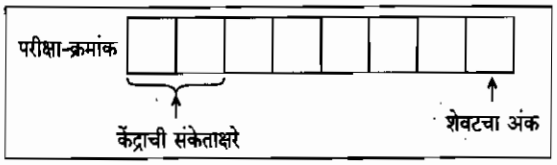
वेळ : 2 (दोन) तास

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 प्रश्नांकडे 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.

(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 चार चुकीच्या उत्तरांसाठी एका प्रश्नाचे 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 व्यक्तीविरूद्ध उक्त अधिनियमानुसार कारवाई करण्यात येईल व दोषी व्यक्ती शिक्षेस पात्र होईल.

पुढील सूचना प्रश्नपुस्तिकेच्या अंतिम पृष्ठावर पहा

पर्यवेक्षकांच्या सूचनेविना हे सील उघडू नये

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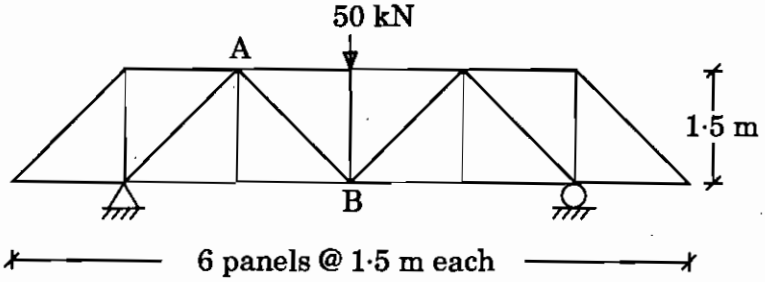
1. "The partial derivative of the total internal energy in a beam, with respect to the load applied at any point is equal to the deflection at that point." This is the statement of

(1) Moment area theorem
(2) Castigliano's second theorem
(3) Conjugate beam theorem
(4) Müller – Breslau's influence theorem

2. For a fixed beam AB, the support B settles by δ downward, then what is the direction of rotation of point A and B ?

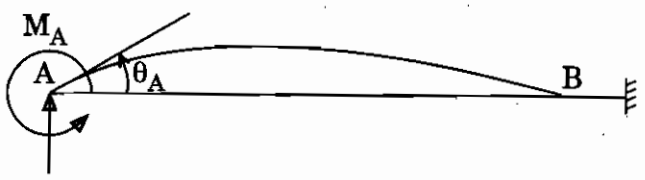
(1) – ve, – ve
(2) + ve, + ve
(3) + ve, – ve
(4) – ve, + ve

3. The force in member AB of the truss shown in the figure below is



(1) 25 kN (c)
(2) $25\sqrt{2}$ kN (t)
(3) $25\sqrt{2}$ kN (c)
(4) 25 kN (t)

4. For the given figure, the moment at A, whose far end is fixed, M_A is



(1) $\frac{3EI}{l}.\theta_A$
(2) $\frac{4EI}{l}.\theta_A$
(3) $\frac{2EI}{l}.\theta_A$
(4) $\frac{6EI}{l}.\theta_A$

5. The distribution factor is

(1) Ratio of stiffness of member and member
(2) Ratio of stiffness of near joint and far joint
(3) Ratio of stiffness of member and joint (sum of member stiffness)
(4) Ratio of stiffness of joint and member

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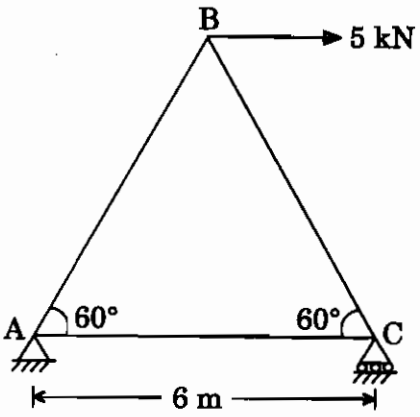
6. Force in the member BC of the truss shown in the figure below is



(1) 5 KN (tensile)
(2) Zero
(3) 2·88 KN (compressive)
(4) 5 KN (compressive)

---

7. A fixed beam AB of span L is subjected to a clockwise moment M at a distance 'a' from end A. Fixed end moment at end A will be

(1) $\frac{M}{L^2}(L-a)(L-3a)$ (2) $\frac{M}{L^2}a(2L-3a)$

(3) $\frac{M}{L^2}a(L-a)$ (4) $\frac{M}{L^2}(L-a)(2L-a)$

---

8. A beam of span l is fixed at one end and simply supported at other end. It carries uniformly distributed load of w per unit run over the whole span. The reaction (R) at the simply supported end is

(1) $R = \frac{3}{8}wl$ (2) $R = \frac{5}{8}wl$

(3) $R = \frac{1}{2}wl$ (4) $R = \frac{1}{3}wl$

---

9. Degree of static indeterminacy of a rigid jointed plane frame having 15 members, 3 reaction components and 14 joints is

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

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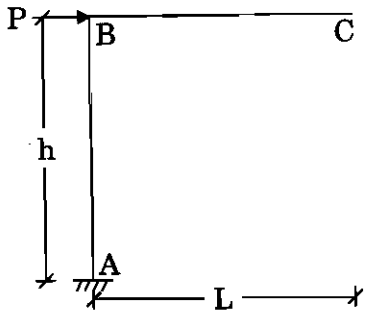
10. A rigid cantilever frame ABC is loaded and supported as shown in the figure below. The horizontal displacement of point C is

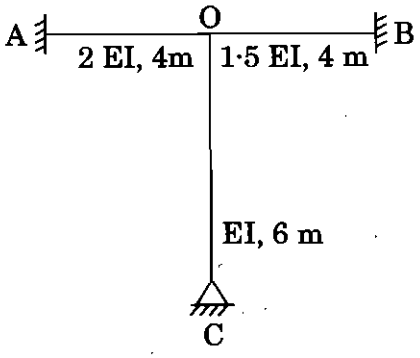


(1) $\frac{2\,Ph^3}{3EI}$ (2) $\frac{Ph^2(2h + L)}{2EI}$

(3) $\frac{Ph^3}{3EI}$ (4) $\frac{Ph^2(h + L)}{3EI}$

---

11. The distribution factor for the members OA, OB and OC are



(1) 0·125, 0·375, 0·5

(2) 0·375, 0·5, 0·125

(3) 0·5, 0·125, 0·375

(4) 0·5, 0·375, 0·125

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12. The stiffness co-ethcients K_{ij} indicate

(1) Force at i due to a unit deformation at j

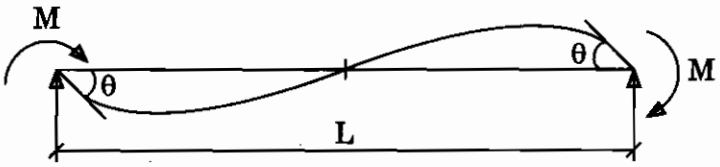
(2) Deformation at j due to a unit force at i

(3) Deformation at i due to a unit force at j

(4) Force at j due to a unit deformation at i

---

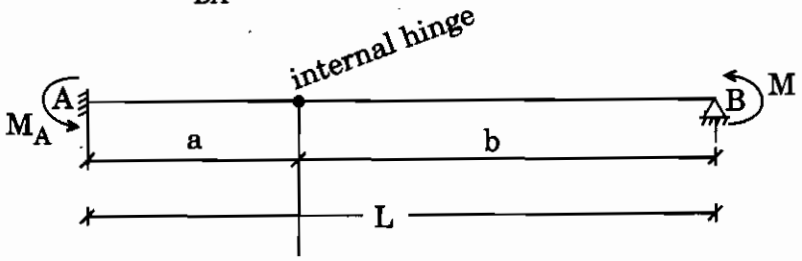
13. A beam EI-constant of span L is subjected to clockwise moments M at both the ends A and B. The rotation of end A works out to be



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

---

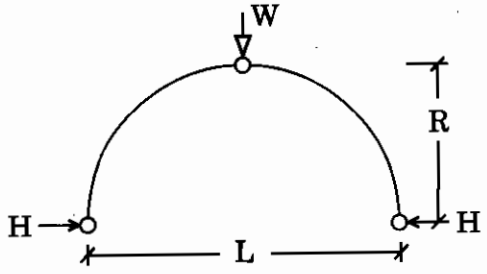
14. Carry-over factor C_{BA} for the beam shown in the figure below is



(1) a/b (2) 3/4 (3) a/L (4) 1/2

---

15. For a three-hinged parabolic arch, what will be the ratio L/R to satisfy H = W ?



(1) 0·50 (2) 1·50 (3) 2·00 (4) 4·00

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16. Match the following :

a.	Three-hinged arch	I.	Statically indeterminate to third degree
b.	Two-hinged arch	II.	Statically indeterminate to first degree
c.	Hingeless arch	III.	Statically determinate

	a	b	c
(1)	I	II	III
(2)	III	II	I
(3)	II	I	III
(4)	II	III	I

---

17. What is *true* for flexibility and stiffness matrix ?

a. They are square matrix

b. The diagonal elements are non-zero and having positive values

c. Element ij= Element ji

d. They are inverse of each other

Answer Options :

(1) a and b

(2) All of the above

(3) c and d

(4) a, c, and d

---

18. Muller – Breslau Principle in structural analysis is used for

(1) Drawing ILD for any force function

(2) Writing virtual work equation

(3) Superposition of load effects

(4) None of the above

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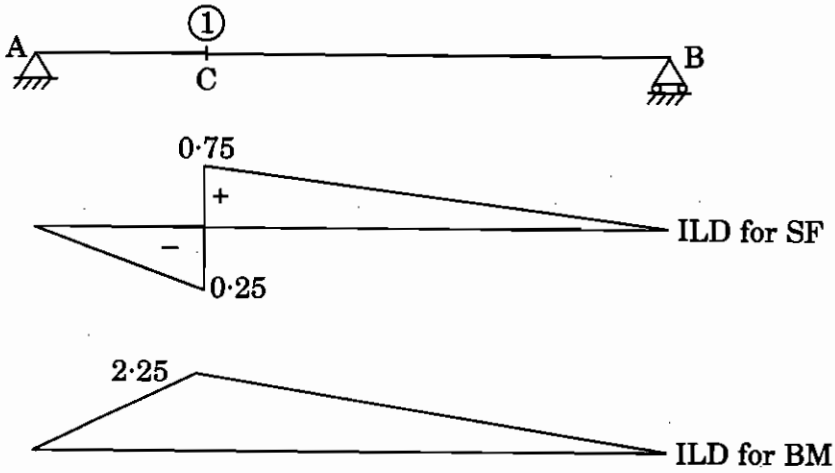
19. The given figure shows ILD for SF and BM at section 1

AC = 3 m, BC = 9 m

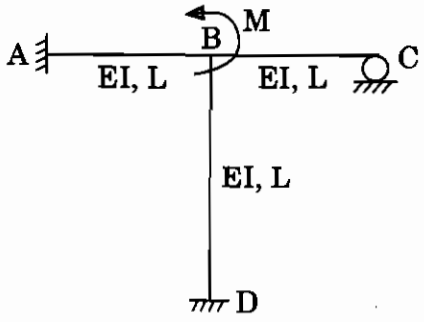


The value of SF and BM at (1) due to concentrated load of 20 kN at mid span will be

(1) 0·75 kN and 2·25 kN-m (2) 5 kN and 5 kN-m

(3) 7·5 kN and 10 kN-m (4) 10 kN and 30 kN-m

20. All members of the frame shown below have the same flexural rigidity EI and length L. If a moment M is applied at joint B, the rotation of the joints is



(1) $\frac{ML}{12EI}$ (2) $\frac{ML}{11EL}$ (3) $\frac{ML}{8EI}$ (4) $\frac{ML}{7EI}$

21. A stiffness matrix is to be generated for beam AB as horizontal flexural member. As per the method adopted for calculation of stiffness matrix, if end A is given translational displacement in vertically upward direction, the end forces generated at end 'B' are

(1) No forces at end B

(2) $-12\ EI/L^3$ vertical force and $6EI/L^2$ moment

(3) $-6\ EI/L^2$ vertical force and $2EI/L$ moment

(4) $-6\ EI/L^2$ vertical force and $4EI/L$ moment

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22. If the stiffness matrix of beam element is given as $\frac{2EI}{L}\begin{bmatrix} 2 & -1 \\ -1 & 2 \end{bmatrix}$, then the flexibility matrix is

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

(3) $\frac{L}{3EI}\begin{bmatrix} 2 & 1 \\ 1 & 2 \end{bmatrix}$ (4) $\frac{L}{6EI}\begin{bmatrix} -1 & 2 \\ 2 & -1 \end{bmatrix}$

23. The inclination of a lacing bar with the axis of the compression member is θ. Then 'θ' shall ***not*** be less than

(1) 30° (2) 40° (3) 50° (4) 70°

24. A column splice is used to increase

(1) the length of the column (2) the strength of the column

(3) the rigidity of the column (4) the cross-sectional area of the column

25. In a cantilever plate girder to prevent web buckling, horizontal stiffeners are provided running along the span. They are provided

(1) below the neutral axis

(2) over the entire cross-section (above as well as below neutral axis)

(3) above the neutral axis

(4) None of the above

26. Number of bolts requited in a bolted joint is equal to

(1) $\frac{\text{Force}}{\text{Bolt value}}$ (2) $\frac{\text{Force}}{\text{Strength of bolt in shearing}}$

(3) $\frac{\text{Force}}{\text{Strength of bolt in bearing}}$ (4) $\frac{\text{Force}}{\text{Strength of bolt in tearing}}$

27. The deflection of beams may be decreased by

(1) Increasing the depth of beam (2) Increasing the span

(3) Decreasing the depth of beam (4) Increasing the width of beam

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28. The Indian standard code which deals with steel structures is

(1) IS : 456 (2) IS : 875 (3) IS : 800 (4) IS : 1893

29. Slenderness ratio of lacing bars should ***not*** exceed

(1) 100 (2) 120 (3) 145 (4) 180

30. The effective length of fillet weld is taken as

(1) the actual length plus twice the size of weld.

(2) the actual length minus twice the size of weld.

(3) the actual length plus thrice the size of weld.

(4) the actual length minus thrice the size of weld.

31. The fusible material used in welding to dissolve and facilitate the removal of oxides and other undesirable substances is known as

(1) inert material (2) inert gas

(3) flux (4) catalytic agent

32. Which of the following equations is correct for both, subjected to both combined shear and tension ?

Where, V = Applied shear at service load

V_{sdf} = Design shear strength

T_e = Externally applied tension at service load

T_{ndf} = Design tension strength

(1) $\left(\frac{V}{V_{sdf}}\right)^2 + \left(\frac{T_e}{T_{ndf}}\right)^2 \leq 1$ (2) $\left(\frac{V}{V_{sdf}}\right)^2 + \left(\frac{T_e}{T_{ndf}}\right)^2 \geq 1$

(3) $\left(\frac{V}{V_{sdf}}\right) + \left(\frac{T_e}{T_{ndf}}\right) \leq 1$ (4) $\left(\frac{V}{V_{sdf}}\right) + \left(\frac{T_e}{T_{ndf}}\right) \geq 1$

33. What is the yield strength of bolt of class 4·6 ?

(1) 400 N/mm^2 (2) 240 N/mm^2

(3) 250 N/mm^2 (4) 500 N/mm^2

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34. What are the different limit states of design as per IS 456 : 2000 ?

a. Limit state of failure

b. Limit state of damage

c. Limit state of collapse

d. Limit state of serviceability

Answer Options :

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

---

35. Maximum shear force for three equal spans of beam/slab occur at

(1) inner side of end support

(2) inner side of support next to end support

(3) outer side of support next to end support

(4) outer side of end support

---

36. In the design of slab, the diameter of reinforcing bars shall ***not*** exceed

(1) one-eighth of overall thickness of slab

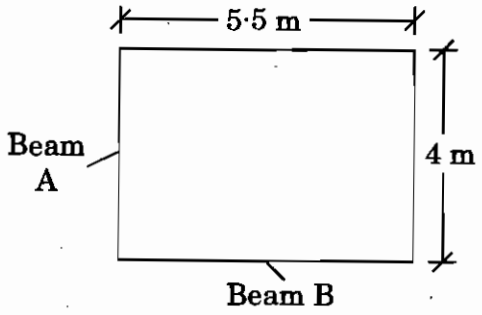
(2) one-fourth of overall thickness of slab

(3) one-half of overall thickness of slab

(4) one-third of overall thickness of slab

---

37. Determine the slab area of which load is acting on supporting beams A and B



(1) 5·5 m^2 and 7·0 m^2

(2) 4·0 m^2 and 5·5 m^2

(3) 7·0 m^2 and 4·0 m^2

(4) 4·0 m^2 and 7·0 m^2

---

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38. A Tee-beam behaves as a rectangular beam of a width equal to its flange if its neutral axis

(1) remains within the flange
(2) remains below the slab
(3) coincides with the geometrical centre of the beam
(4) None of the above

---

39. According to IS 456, two-way slabs with corners held down are assumed to be divided in each direction into middle strips and edge strips such that the width of middle strip is,

(1) half of the width of the slab
(2) two-third of the width of the slab
(3) three-fourth of the width of the slab
(4) four-fifth of the width of the slab

---

40. Span effective depth ratio for cantilever for span upto 10 m is

(1) 7 (2) 20 (3) 26 (4) 35

---

41. Effective length of compression member which is effectively held in position and restrained against rotation at both ends is

(1) $0{\cdot}65\,l$ (2) $0{\cdot}75\,l$ (3) $0{\cdot}80\,l$ (4) $0{\cdot}85\,l$

---

42. If 'H' is the total height of the building, under transient wind load the lateral sway at the top should ***not*** exceed

(1) $\frac{H}{200}$ (2) $\frac{H}{300}$ (3) $\frac{H}{400}$ (4) $\frac{H}{500}$

---

43. An axially loaded column is 300 × 300 mm in size, effective length of column is 3 m. What is the minimum eccentricity of the axial load for column ?

(1) 20 mm (2) 16 mm (3) 10 mm (4) 0

---

44. In reinforced and plain concrete footings on soils, the thickness at the edge shall be ***not*** less than

(1) 200 mm (2) 150 mm (3) 300 mm (4) 250 mm

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45. The maximum permissible final deflection of a beam should ***not*** exceed

(1) span / 350 (2) span / 250

(3) span / 480 (4) span / 500

---

46. The maximum effective reinforcement ratio of a bonded prestressed concrete beam at failure according to IS : 1343 is limited to a value of

(1) 0·15 (2) 0·40

(3) 0·25 (4) 0·50

---

47. The moment of resistance of a rectangular section depends upon

(1) ultimate strain in concrete

(2) area of high tensile tendons

(3) tensile strength in concrete

(4) compressive stress in concrete

---

48. In case of prestressed concrete element, which statement is ***not*** correct ?

(1) Concrete remains uncracked and it protects steel from corrosion.

(2) It can be used more effectively in liquid retaining structures.

(3) The stiffness of structure is less due to uncracked condition of concrete.

(4) Shear resisting capacity is increased due to pre-compression.

---

49. Prestressing force transmitted to concrete as initial internal stress to counteract the internal stress developed due to external loads is called

(1) Stress concept

(2) Strength concept

(3) Force concept

(4) Load balancing concept

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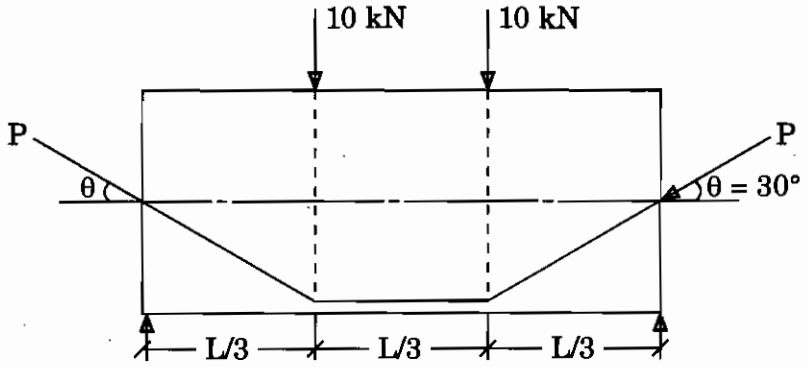
50. A simply supported beam of span 9 m is subjected to two point loads, each of 10 kN acting at $\frac{1}{3}$ of span as shown in the figure. If self-weight of beam is neglected, then how much prestressing force is required to counter-balance the external loads if $\theta = 30°$?



(1) 5 kN

(2) 10 kN

(3) 20 kN

(4) 30 kN

51. The approximate value of shrinkage strain for design of post-tensioning member is Where 't' = age of concrete at transfer in days.

(1) $\frac{0{\cdot}0001}{\log_{10}(t+2)}$

(2) 0·0003

(3) $\frac{0{\cdot}0002}{\log_{10}(t+2)}$

(4) $\frac{0{\cdot}0003}{\log_{10}(t+2)}$

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52. The partial safety factors for material strength are

(1) 1·15 for concrete and 1·5 for steel

(2) 1·5 for concrete and 1·15 for steel

(3) 1·5 for both concrete and steel

(4) 1·15 for both concrete and steel

---

53. A post-tensioned prestressed concrete beam is having a cross-section of 300 × 300. The area of end block is 100 × 100 mm. Instead of 100 × 100 mm end block, 150 mm × 150 mm end block is provided. What will be the reduction in bursting forces ? Let the load in tendons be P_k.

(1) $0{\cdot}03\ P_k$ (2) $0{\cdot}04\ P_k$ (3) $0{\cdot}045\ P_k$ (4) $0{\cdot}05\ P_k$

---

54. Prestressing in a concrete beam with sloping or curve profile

(1) increases shear strength

(2) increases flexural strength

(3) decreases shear strength

(4) Both (1) and (2)

---

55. The bearing stress on concrete after accounting for all losses due to relaxation of steel, elastic shortening, creep of concrete, slip and seating of anchorage shall ***not*** exceed _____

(where, f_{ci} is the concrete strength at transfer, A_{br} is bearing area and A_{pun} is punching area)

(1) $0{\cdot}16\ f_{ci}\sqrt{\frac{A_{br}}{A_{pun}}}$ or $0{\cdot}8\ f_{ci}$ whichever is smaller

(2) $0{\cdot}48\ f_{ci}\sqrt{\frac{A_{br}}{A_{pun}}}$ or $0{\cdot}8\ f_{ci}$ whichever is smaller

(3) $0{\cdot}25\ f_{ci}\sqrt{\frac{A_{br}}{A_{pun}}}$ or $0{\cdot}8\ f_{ci}$ whichever is smaller

(4) $0{\cdot}34\ f_{ci}\sqrt{\frac{A_{br}}{A_{pun}}}$ or $0{\cdot}8\ f_{ci}$ whichever is smaller

---

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56. The difference between EST of succeeding activity and EFT of the activity under consideration is called

(1) Total float
(2) Independent float
(3) Interfering float
(4) Free float

---

57. Which of the following are the methods of scheduling ?

(1) Bar charts or Gantt charts
(2) Milestone charts
(3) Network anaysis
(4) All of the above

---

58. The excess of minimum available time over activity duration is called

(1) total float (2) free float
(3) independent float (4) None of the above

---

59. Which of the following are the significant achievements of Taylor towards scientific management approach ?

(1) Work study
(2) Incentive scheme
(3) Standardisation of tools and equipment or workman and working conditions
(4) All of the above

---

60. Which of the following networks is activity oriented ?

(1) PERT (2) CPM
(3) Both (1) and (2) (4) None of the above

---

61. The time required to complete an activity under abnormal or extremely adverse conditions in which everything goes wrong is called

(1) optimistic time
(2) most likely time
(3) pessimistic time
(4) None of the above

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62. What is the purpose of job layout ?

(1) To provide more economical methods of working

(2) Shorter leads of materials

(3) Reduction in completion time

(4) All of the above

63. Which of the following codes is relevant to fire safety ?

(1) IS 456 – 2000

(2) IS 1256 – 1967

(3) IS 800 – 1950

(4) None of the above

64. What is dummy activity ?

(1) Activity having zero duration

(2) Activity shown by dotted line

(3) Activity which shows dependency

(4) All of the above

65. Which of the following sentences is correct ?

(1) Except initial and end events, all events in the network are dual role events.

(2) All events in the network are dual role events.

(3) There is only one dual role event in the network.

(4) None of the above

66. PERT stands for

(1) Perfect Evaluation and Review Technique

(2) Programme Elongation and Review Technique

(3) Programme Evaluation and Review Technique

(4) None of the above

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67. Floating point form representation of a real number x is denoted by $x = f \times 10^E$ in which 'f' is called

(1) Sign bit (2) Exponent

(3) Partial derivative (4) Mantissa

---

68. What will be the next approximation for finding a real root of equation $x^3 - 2x - 5 = 0$; if it is solved using the Newton–Raphson method and initial approximation of $x = 2$?

(1) 2·4 (2) 2·3

(3) 2·1 (4) 2·2

---

69. An iterative formula to find $\sqrt{Y}$ (where Y is a positive number) by the Newton–Raphson technique is given by expression

(1) $x_{i+1} = \frac{1}{4}\left(x_i + \frac{Y}{x_i}\right)$ (2) $x_{i+1} = \frac{1}{3}\left(x_i + \frac{Y}{x_i}\right)$

(3) $x_{i+1} = \frac{1}{2}\left(x_i + \frac{Y}{x_i}\right)$ (4) $x_{i+1} = \frac{1}{4}\left(x_i - \frac{Y}{x_i}\right)$

---

70. The area under straight line is an estimate of the integral of f(x) between the limits a and b and the result of this integration is called trapezoidal rule. The formula used in area calculation by this rule is

(1) $I = (a - b)\frac{f(a) + f(b)}{4}$ (2) $I = (b - a)\frac{f(b) - f(a)}{2}$

(3) $I = (b - a)\frac{f(a) + f(b)}{2}$ (4) $I = (b - a)\frac{f(a) + f(b)}{3}$

---

71. The method in which both sides of equations are multiplied by non-zero constant is classified as

(1) Gaussian elimination method

(2) Gaussian inconsistent procedure

(3) Gaussian consistent procedure

(4) Gaussian substitute procedure

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72. The two segment trapezoidal rule of integration is exact for integrating at most _____ order polynomials.

(1) first (2) second

(3) third (4) fourth

---

73. Division by zero during forward elimination steps in Naive Gaussian Elimination of the set of equation [A][X] = [C] implies the coefficient matrix [A]

(1) is invertible

(2) is non-singular

(3) may be singular or non-singular

(4) is singular

---

74. What will be the value of function $f(x) = x^3 + 2x - 2 = 0$ in the next iteration if $f(0) = -2$ and $f(1) = 1$?

(1) $-0{\cdot}625$ (2) $-0{\cdot}725$

(3) $-0{\cdot}875$ (4) $-0{\cdot}975$

---

75. For the equation $f(x) = x^2 - x - 1 = 0$, a root lies between 1 and 2. The root of equation at second interval by bisection method is

(1) 1·5 (2) 2

(3) 1·66 (4) 1·75

---

76. The root of equation $x^3 - 4x - 9 = 0$ using the bisection method is

(1) 1·6875 (2) 2·6875

(3) 3·6875 (4) 4·6875

---

77. In the solution of simultaneous equations by the Gauss elimination method for solving equations, triangularization leads to

(1) singular matrix

(2) upper triangular matrix

(3) diagonal matrix

(4) lower triangular matrix

---

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78. Hardness of the stones can be tested by _____ in the laboratory.
(1) Impact strength (2) Abrasion strength
(3) Mohr's scale (4) Crushing strength

79. Which of the following tests is used for measuring the workability of the concrete ?
(1) Chloride penetration test
(2) Slump test
(3) Initial setting time test
(4) Standard consistency test

80. For aggregate ratio of order of _____ , the workability is independent of the Aggregate Cement Ratio.
(1) 1·0 (2) 1·5 (3) 2·0 (4) 3·0

81. Rankine's formula for finding the minimum depth of foundation for loose soil is
(1) $d = \frac{q}{\gamma}\left(\frac{1+\sin\phi}{1-\sin\phi}\right)$ (2) $d = \frac{q}{\gamma}\left(\frac{1-\sin\phi}{1+\sin\phi}\right)^2$
(3) $d = \frac{q}{\gamma}\left(\frac{1-\sin\phi}{1+\sin\phi}\right)$ (4) $d = \frac{q}{\gamma}\left(\frac{1+\sin\phi}{1-\sin\phi}\right)^2$

82. White lead, red lead, oxides of zinc, oxides of iron are the substances used in the formation of paints of
(1) Vehicle (2) Drier (3) Carrier (4) Base

83. What is the name of the wooden plank or slab of concrete or stone usually provided at the bottom of an entrance door ?
(1) Jamb (2) Reveal (3) Cornice (4) Threshold

84. In testing final setting time of cement a needle of
(1) 1 mm square section is used
(2) 1 mm diameter is used
(3) 2 mm square section is used
(4) 5 mm square section is used

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85. Which of the following is ***not*** a non-destructive method of testing concrete ?

(1) Rebound test
(2) Radioactive penetration method
(3) Soundness test
(4) Dynamic or vibration test

86. In public halls and auditoriums, the sound persists even after the source of sound has ceased. This persistence of sound is called

(1) Absorption (2) Echoes
(3) Reverberation (4) Reflection of sound

87. The lime which has high calcium oxide content and is dependent for setting and hardening solely on the absorption of carbon dioxide from the atmosphere is known as

(1) Quick lime (2) Fat lime
(3) Hydraulic lime (4) Hydrated lime

88. What should be the aspect for a bedroom ?

(1) West (2) North-West
(3) South-West (4) All of the above

89. For roominess, length to width ratio should be

(1) 1 : 1 to 1 : 5 (2) 1·2 : 1 to 1·5 : 1
(3) 1·5 : 1 to 2 : 1 (4) 1·5 : 1 to 1·75 : 1

90. At a point in the web of a girder the bending stress (σ_x) is 3 MPa (tensile) and the shearing stress (τ) at the same point is 2 MPa, then the maximum shear stress is

(1) 1·5 MPa (2) 4 MPa (3) 2·5 MPa (4) 1 MPa

91. A beam of length 10 m carries a uniformly distributed load of 20 KN/m over its entire length and rests on two simple supports. In order that the maximum BM produced in the beam is the least possible, the supports must be placed from the ends at a distance of

(1) 5·86 m (2) 4·14 m (3) 2·93 m (4) 2·07 m

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92. Choose the correct relation between modulus of elasticity (E), modulus of rigidity (G) and bulk modulus (K) from the following options :

(1) $\frac{2}{E} = \frac{9}{G} + \frac{3}{K}$ (2) $\frac{9}{E} = \frac{3}{G} + \frac{1}{K}$

(3) $\frac{3}{E} = \frac{9}{G} + \frac{1}{K}$ (4) $\frac{1}{E} = \frac{9}{G} + \frac{3}{K}$

---

93. In a simple bending theory, one of the assumptions is that the material of the beam is isotropic. This assumption means that the

(1) normal stress remains constant in all directions

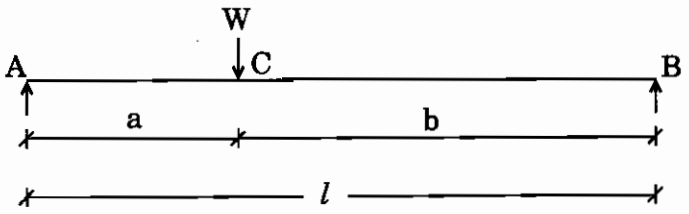
(2) normal stress varies linearly in the material

(3) elastic constants are same in all the directions

(4) elastic constants vary linearly in the material

---

94. A simply supported beam of length 'l' carries a point load 'W' at point 'C' as shown in the figure. The maximum deflection lies at



(1) Point A

(2) Point B

(3) Point C

(4) Between points B and C

---

95. In the torsion equation

$$\frac{T}{J} = \frac{\tau}{R} = \frac{C.\theta}{l}$$

the term $\frac{J}{R}$ is called

(1) Shear modulus (2) Section modulus

(3) Polar modulus (4) None of the above

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96. Two solid shafts 'A' and 'B' are made of the same material. The shaft 'A' is of 50 mm diameter and shaft 'B' is of 100 mm diameter. The strength of shaft 'B' is _____ of that of shaft 'A'.

(1) one-half (2) double

(3) four times (4) eight times

---

97. The shear force on a simply supported beam is proportional to

(1) displacement of the neutral axis

(2) sum of the forces

(3) sum of the transverse forces

(4) algebraic sum of the transverse forces

---

98. Deflection of the free end of cantilever having point load at the mid span is

(1) $\frac{Wl^3}{3EI}$ (2) $\frac{5Wl^3}{24EI}$

(3) $\frac{5Wl^3}{48EI}$ (4) $\frac{Wl^3}{48EI}$

---

99. An element in a strained body is subjected to only shear stress of intensity 50 MPa tending to rotate the body in clockwise direction. What is the magnitude of principal stresses ?

(1) $\pm$ 50 MPa (2) + 50 MPa, – 25 MPa

(3) + 25 MPa, – 50 MPa (4) $\pm$ 25 MPa

---

100. Strain energy stored in a solid shaft due to application of Torque 'T' at free end while other end is fixed, if G is shear modulus, J is polar moment of inertia, and L is the length of shaft is/will be

(1) $\frac{TL^2}{GJ}$ (2) $\frac{T^2L^2}{2GJ}$

(3) $\frac{2TL^2}{GJ}$ (4) $\frac{T^2L}{2GJ}$

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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 परीक्षा कक्षाबाहेर जाण्यापूर्वी उमेदवाराने आपल्या उत्तरपत्रिकेचा भाग-1 समवेक्षकाकडे न विसरता परत 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

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 उत्तरक्रमांक 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.**

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