महाराष्ट्र राजपत्रित तांत्रिक सेवा (मुख्य) स्पर्धा परीक्षा
आर्किटेक्चरल सेवा (स्थापत्य), गट-क व ब (मुख्य) प.२०२१.
परीक्षा - दिनांक - २९ ऑक्टोबर, 2022.

2021

G16

संच क्र. A

A

प्रश्नपुस्तिका – I
स्थापत्य अभियांत्रिकी पेपर – 1

प्रश्नपुस्तिका क्रमांक BOOKLET NO. 103721

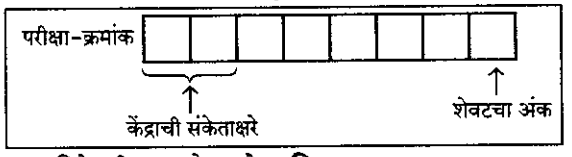
वेळ : 2 (दोन) तास

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 उत्तर-क्रमांक नमूद करताना तो संबंधित प्रश्न-क्रमांकासमोर 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. 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/कमी करण्यात येतील''.**

पर्यवेक्षकांच्या सूचनेविना हे सी

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

कच्च्या कामासाठी जागा / SPACE FOR ROUGH WORK

1. A simply supported beam is subjected to a uniformly distributed load of intensity W per unit length, on half of the span from one end. The length of the span and the flexural stiffness are denoted as l and El respectively. The deflection at mid-span of the beam is

(1) $\frac{5}{6144}\frac{Wl^4}{El}$ (2) $\frac{5}{768}\frac{Wl^4}{El}$ (3) $\frac{5}{384}\frac{Wl^4}{El}$ (4) $\frac{5}{192}\frac{Wl^4}{El}$

---

2. Indeterminancy in the structure may result from

(a) Multiple reactions

(b) Extra bars in truss

(c) Fixed supports in frames

(d) Geometry of the structures

Answer Options :

(1) Only (a), (b) and (c) (2) Only (b), (c) and (d)

(3) None of the above (4) All of the above

---

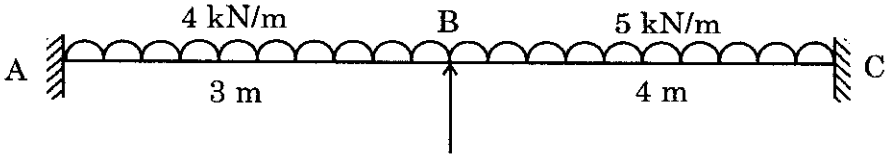
3. Which of the following is carried by truss member ?

(1) Axial load (2) Shear load

(3) Flexure load (4) All of the above

---

4. Referring to the following beam, what are the slope deflection equations for moments M_{AB} and M_{BC} ?



(1) $M_{AB} = -3 + 0.667\ EI\theta_B$ and $M_{BC} = -6.67 + EI\theta_B$

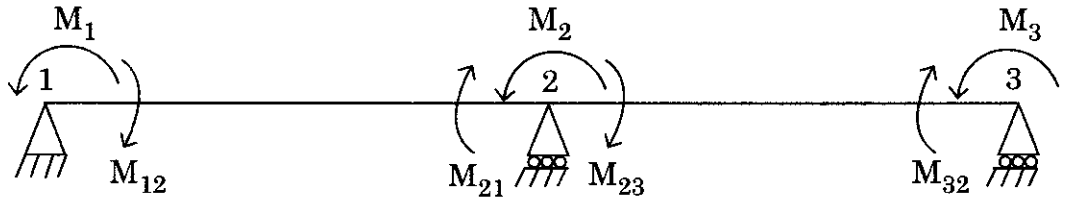
(2) $M_{AB} = 3 + 1.333\ EI\theta_B$ and $M_{BC} = 6.67 + 0.5\ EI\theta_B$

(3) $M_{AB} = 3 - 0.667\ EI\theta_B$ and $M_{BC} = -6.67 + EI\theta_B$

(4) $M_{AB} = -3 + 1.333\ EI\theta_B$ and $M_{BC} = -6.67 + 0.5\ EI\theta_B$

---

5. Pick the correct moment equilibrium conditions considering the following figure.



(1) $M_{12} = M_1, M_{21} + M_{23} = M_2, M_{32} = M_3$

(2) $M_{12} = M_1, M_{21} - M_{23} = M_2, M_{32} = M_3$

(3) $M_{12} = -M_1, M_{21} + M_{23} = M_2, M_{32} = M_3$

(4) None of the above

6. Pick up the correct statement with respect to moment distribution method.

(a) The moment distribution method consists in successively locking and releasing the joints.

(b) The first locking moments are the fixed end moments due to applied loading.

Answer Options :

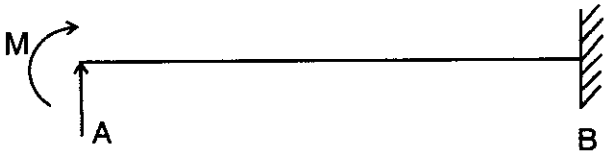
(1) (a) is correct; (b) is incorrect

(2) (b) is correct; (a) is incorrect

(3) Both (a) and (b) are correct

(4) Both (a) and (b) are incorrect

7. Carryover moment at end B due to moment M applied at end A for the given propped cantilever beam is



(1) + M (2) − M (3) $+\frac{M}{2}$ (4) $-\frac{M}{2}$

8. Who has invented and when the method of moment distribution ?

(1) Timoshenko S. (1921)

(2) Calisev K. A. (1922)

(3) George A. M. (1915)

(4) Hardy Cross (1930)

कच्च्या कामासाठी जागा / SPACE FOR ROUGH WORK

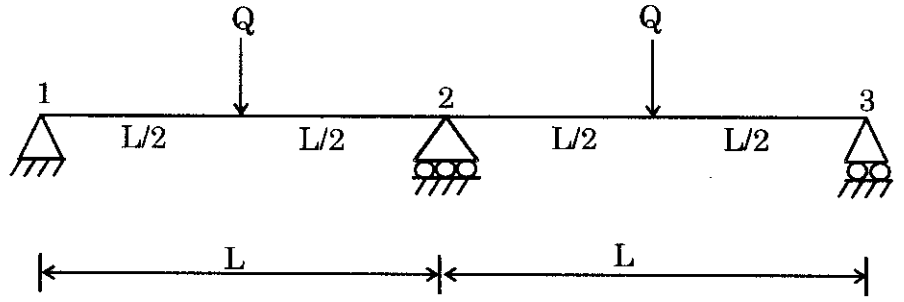
9. Distribution factor for a member depends on the

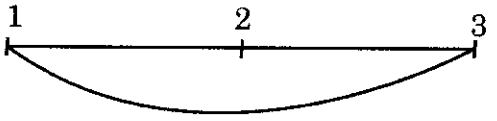
(1) Stiffness and Loading
(2) Only stiffness factors
(3) Only loading
(4) Neither stiffness nor loading

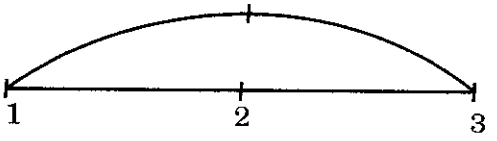
10. Who has developed latest slope deflection method ?

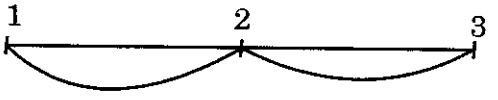
(1) Prof. Hardy Cross
(2) Prof. Maxwell
(3) Prof. George A. Maney
(4) Alberto Castiglino

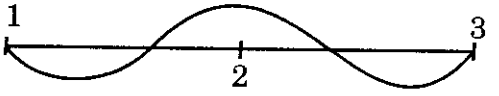
11. Pick up the correct elastic curve of the beam as shown in figure.



(1) 

(2) 

(3) 

(4) 

कच्च्या कामासाठी जागा / SPACE FOR ROUGH WORK

12. The value of effective length coefficient for the column fixed at both ends

(1) 1.0 (2) 1.2

(3) 0.8 (4) 0.65

---

13. Anchor bolts are provided in column bases to

1. Resist the tension forces.
2. Fix columns in place during erection.
3. Serve as reinforcement in concrete pedestal below the base plate of the above.

Answer Options :

(1) 1 and 2 are correct

(2) 2 and 3 are correct

(3) 3 and 1 are correct

(4) All 1, 2 and 3 are correct

---

14. Pick up the correct statement corresponds to design of flexural members.

(i) The design bending strength of laterally supported beam is governed by the yield stress.

(ii) The design bending strength of laterally unsupported beam is governed by lateral torsional buckling strength.

Answer Options :

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

(2) (i) is correct and (ii) is incorrect

(3) (i) is incorrect and (ii) is correct

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

---

15. To prevent local crushing of the web due to concentrated loading which stiffeners are provided

(1) Intermediate transverse web stiffeners

(2) Bearing stiffeners

(3) Torsion stiffeners

(4) Load carrying stiffeners

कच्च्या कामासाठी जागा / SPACE FOR ROUGH WORK

16. The aspect ratio for end panel of a plate girder designed without using tension field action should be in range

(1) 0.3 to 0.5 (2) 0.6 to 1.0

(3) 1.0 to $\sqrt{2}$ (4) $\sqrt{2}$ to 3.0

17. If the diameter of bolt is 20 mm then the maximum number of bolt that can be accommodated in one row in a 140 mm wide flat is

(1) 2 (2) 3

(3) 6 (4) 1

18. In order to account for shear deformation effect, the ratio of effective slenderness ratio of laced columns to the actual slenderness ratio is

(1) 1.0 (2) 1.05

(3) 1.25 (4) 1.5

19. The effective throat thickness of a fillet weld is K times the size of the weld. For a 70° angle between fusion faces, K is

(1) 0.65 (2) 0.7

(3) 0.6 (4) 1.0

20. The top chord of a roof truss is inclined at an angle of 22°. No access is provided for maintenance. The live load to be considered for the design will be

(1) Zero (2) 0.75 kN/m^2

(3) 1.5 kN/m^2 (4) 0.61 kN/m^2

21. Which connections are designed to transfer bending moments and shear or a combination of bending moment, shear and axial force

(1) Eccentrically loaded connections

(2) T-stub connections

(3) Flange angle connections

(4) All of the above

22. In a simply supported beam of span L, each end is restrained against torsion, compression flange being unrestrained. According to IS : 800, the effective length of the compression flange will be equal to

(1) L (2) 0.85 L

(3) 0.75 L (4) 1.20 L

23. The effective prestress after all losses should not be less than _____ where f_p is the characteristic strength of prestressing steel.

(1) 0.60 f_p (2) 0.45 f_p (3) 0.87 f_p (4) 0.65 f_p

24. As per IRC 18 – 2000, A minimum clear distance of _____ or _____ of the duct, whichever is greater, shall be maintained between individual cables when grouping of cables is not involved. Consider 'd' as diameter of duct.

(1) 30 mm or d (2) 50 mm or d

(3) 80 mm or 2d (4) 100 mm or 2d

25. The moment of resistance of rectangular section or T-Sections in which neutral axis lies within the flange is

(1) $M = f_{pu} A_p (d + 0.42 x_u)$ (2) $M = f_{pu} A_p (d - 0.42 x_u)$

(3) $M = f_{pu} A_p + (d + 0.42 x_u)$ (4) $M = f_{pu} A_p - (d - 0.42 x_u)$

26. Calculate the slope angle such that eccentricity is 750, length is 40 m and stress induced is 1000 N/m^2.

(1) 0.89 (2) 0.075

(3) 0.054 (4) 0.065

27. How the web thickness of long-span girders with curved cables is estimated ?

(1) $b_w = 0.85 \frac{V_u}{f_t.h}$ (2) $b_w = 0.60 \frac{V_u}{f_t.h}$

(3) $b_w = 0.87 \frac{V_u}{f_t.h}$ (4) $b_w = 0.65 \frac{V_u}{f_t.h}$

कच्च्या कामासाठी जागा / SPACE FOR ROUGH WORK

28. A prestressed concrete simply supported beam of span 10 m is subjected to U.D.L. of 8 kN/m over entire span. If the prestressing force of 800 kN is applied through concentric cables, then stresses developed at extreme fibre at support will be equal to _____. Consider c/s of beam as 200 mm × 400 mm. Neglect the self weight of beam.

(1) 10 N/mm^2 (2) 12.5 N/mm^2

(3) 15 N/mm^2 (4) 20 N/mm^2

29. Friction losses can be reduced by

a. Overtensioning the tendons by an amount equal to the maximum frictional losses.

b. Jacking the tendons from both ends of the beam.

Pick up the correct statement with respect to frictional losses in prestress.

Answer Options :

(1) a is correct; b is incorrect

(2) a is incorrect; b is correct

(3) Both are correct

(4) Both are incorrect

30. Which of the following is included in the extreme environment exposure condition in the analysis of prestressed concrete ?

(1) Concrete exposed to condensation and rain

(2) Concrete in contact with or buried under aggressive sub soil/ground water

(3) Members in direct contact with liquid/solid aggressive chemicals

(4) All of the above

31. A beam of symmetrical I-Section, 8 m span has flange width of 250 mm and flange thickness 80 mm, overall depth is 450 mm, eccentricity is 150 mm, $w_1 = 1.57$ kN/m, $w_2 = 2.5$ kN/m. Determine effective force.

(1) 250 kN (2) 217 kN

(3) 320 kN (4) 200 kN

कच्च्या कामासाठी जागा / SPACE FOR ROUGH WORK

32. Relaxation losses for prestressing steel at 1000 h. at 20 ± 2° C for initial stress of 0.5 f_p is _____ for normal relaxation. Where, f_p is the characteristic strength of prestressing steel.

(1) 0% (2) 1.0% (3) 3.0% (4) 5.0%

33. Pick up the correct statement with respect to loss of prestress due to shortening of concrete in pre-tensioned members.

a. The losses of prestressed should be calculated on a modular ratio basis using the stress in the adjacent concrete.

b. The loss of prestress should be calculated on the basis of half the product of the stress in the concrete adjacent to the tendons averaged along their lengths and the modular ratio.

Answer Options :

(1) Both a and b are correct (2) Both a and b are incorrect

(3) a is correct ; b is incorrect (4) a is incorrect ; b is correct

34. Using Bisection method, a root of the equation $x^3 - x - 11 = 0$ lies between

(1) $2 < x < 3$ (2) $1 < x < 3$ (3) $1 < x < 2$ (4) $0 < x < 1$

35. The root of the equation $e^x - 3x = 0$ that lies in the interval (1.5, 1.6) using Bisection method after second stage of iteration is

(1) 1.532 (2) 1.525 (3) 1.612 (4) 1.574

36. Identify the correct statement.

(a) While applying Simpson's $\frac{1}{3}$ rule, the given interval must be divided into even number of equal sub-intervals.

(b) While applying Simpson's $\frac{3}{8}$ rule, the number of sub-intervals be taken as multiple of 3.

Answer Options :

(1) (a) is incorrect and (b) is correct (2) (a) is correct and (b) is incorrect

(3) Both (a) and (b) are correct (4) Both (a) and (b) are incorrect

कच्च्या कामासाठी जागा / SPACE FOR ROUGH WORK

37. A solid of revolution is formed by rotating about the x-axis, the area between the x-axis, the lines x = 0, and x = 1 and a curve through the points with following co-ordinates.

x :	0.00	0.25	0.50	0.75	1.00
y :	1.0000	0.9896	0.9589	0.9089	0.8415

Estimate the volume of the solid formed using Simpson's rule.

(1) 2.8192 (2) 1.6205

(3) 3.221 (4) 2.4214

38. Which iterative method is based on interpolation method ?

(1) Bisection method

(2) Newton-Raphson method

(3) Secant method

(4) All of the above

39. Using Gauss elimination method, solutions for the system of equations are

$x + y + z = 6$

$3x + 3y + 4z = 20$

$2x + y + 3z = 13$

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

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

40. If $8x - 3y + 2z = 20$

$4x + 11y - z = 33$

$6x + 3y + 12z = 36$

Then the values of x, y and z variables after first approximation using iterative method (Jacobi method) is

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

(2) x = 2.5, y = 3, z = 3

(3) x = 2.5, y = 3, z = 6

(4) x = 3, y = 2.5, z = 3

कच्च्या कामासाठी जागा / SPACE FOR ROUGH WORK

41. The root of an equation $\text{Sin}x = \frac{1}{x}$ that lies between x = 1 and x = 1.5 measured in radians using bisection method after second stage of iteration is

(1) 1 (2) 1.5

(3) 1.25 (4) 1.125

---

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

(1) $x_{n+1} = \frac{1}{3}\left(x_n + \frac{N}{x_n}\right)$ (2) $x_{n+1} = \frac{1}{2}\left(x_n + \frac{N}{x_n}\right)$

(3) $x_{n+1} = x_n(2 - Nx_n)$ (4) $x_{n+1} = \frac{1}{2}\left(x_n + \frac{1}{Nx_n}\right)$

---

43. Solve :

$3x_1 + x_2 + x_3 = 4$

$x_1 + 4x_2 - x_3 = -5$

$x_1 + x_2 - 6x_3 = -12$

(1) $x_1 = 2, x_2 = -1, x_3 = -1$ (2) $x_1 = 1, x_2 = 2, x_3 = 3$

(3) $x_1 = -1, x_2 = 2, x_3 = -1$ (4) $x_1 = 1, x_2 = -1, x_3 = 2$

---

44. Solve :

$2x_1 + x_2 + 4x_3 = 4$

$x_1 - 3x_2 - x_3 = -5$

$3x_1 - 2x_2 + 2x_3 = -1$

(1) $x_1 = 1, x_2 = -2, x_3 = 1$

(2) $x_1 = 1, x_2 = 2, x_3 = 0$

(3) $x_1 = 2, x_2 = 0, x_3 = 0$

(4) $x_1 = -1, x_2 = -1, x_3 = 2$

कच्च्या कामासाठी जागा / SPACE FOR ROUGH WORK

45. How much is the acceptable indoor source noise level for the T.V. studio ?
(1) 5 – 10 dB
(2) 25 – 30 dB
(3) 50 – 55 dB
(4) 1 – 4.5 dB

46. How much should be the maximum % of impurities in limestone allowed for fat lime ?
(1) 15%
(2) 12%
(3) 5%
(4) 10%

47. What is the main purpose of providing appropriate traps in plumbing and drainage system ?
(1) Preventing foul gases into the building
(2) Preventing foul gases into the septic tank
(3) Preventing leakages from pipes
(4) None of the above

48. A typical service connection to a house/consumer from the main distribution system is called as
(1) Service pipe
(2) Goose neck connection
(3) Ferrule
(4) Mains line

49. What is the range of P.V.C.N. (Pigment Volume Concentration Number) used for painting prime coat on metals ?
(1) 15 to 20
(2) 25 to 40
(3) 106 to 155
(4) 3 to 7

50. For which concrete mix, VeBe test is more suitable ?
(1) Stiff concrete mix having very low workability
(2) Stiff concrete mix having high workability
(3) Loose concrete having medium workability
(4) Any type of concrete mix

कच्च्या कामासाठी जागा / SPACE FOR ROUGH WORK

51. What shall be the range of length to breadth proportion for a good room ?
(1) 1 to 1.1 (2) 2.1 to 2.2
(3) 1.2 to 1.5 (4) 1.60 to 2.00

52. Ideally at which temperature, mixture of naturally occurring argillaceous and calcareous is to be burnt together in order to manufacture ordinary portland cement ?
(1) About 1450°C
(2) About 400°C
(3) About 1200°C
(4) About 750°C

53. What is the horizontal member separating the door and the window from fanlight or ventilator called as ?
(1) Head (2) Mullion (3) Transome (4) Top rail

54. As recommended by concrete association of India the face thickness of hollow concrete blocks should not be more than
(1) 4 cm (2) 2 cm (3) 5 cm (4) 10 cm

55. Which is the joint in a timber roof truss provided with "Gib and cotter clips" which hold the stirrup strap ?
(1) Joint between queen post and principal rafter
(2) Joint between king post and Tie Beam
(3) Joint between strut and principal rafter
(4) None of the above

56. Stripping time (period) for the removal of props to slab spanning over 4.5 m upto 6 m in normal circumstances when ambient temperature does not fall below 15°C and ordinary portland cement is used in casting is
(1) 3 days (2) 7 days (3) 14 days (4) 21 days

कच्च्या कामासाठी जागा / SPACE FOR ROUGH WORK

57. In a grid member, unit rotation is applied along y direction at the near end. The stiffness coefficient along z-axis at the near end, will be

(1) $6EI/l^2$ (2) $-6EI/l^2$

(3) $12EI/l^3$ (4) $4EI/l$

58. Flexibility matrix is known as

(1) Force method

(2) Equilibrium method

(3) Displacement method

(4) None of these

59. If a load of 100 kN is moving on 10 m girder AB. C is a point on the girder at 3 m from support A. Maximum SF@C will be obtained when

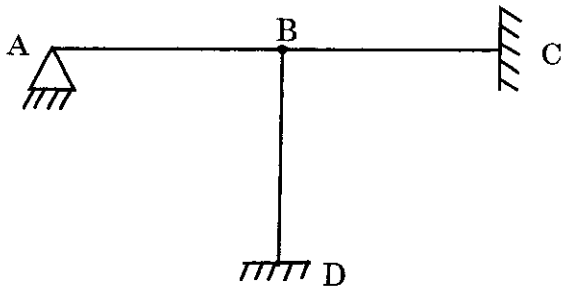
(1) Load is placed at support A

(2) Load is placed at point C

(3) Load is placed at midpoint of the girder

(4) Load is placed at support B

60. Referring to the frame as shown in figure, what should be the size of stiffness matrix before and after imposing the boundary conditions ?



(1) 12×12 and 3×3 (2) 12×12 and 2×2

(3) 6×6 and 3×3 (4) 9×9 and 2×2

कच्च्या कामासाठी जागा / SPACE FOR ROUGH WORK

61. In a given structure if the degree of freedom is more than the redundant forces, then the preferred method of analysis is

(1) Flexibility method
(2) Stiffness method
(3) Equilibrium method
(4) Kani's method

62. A two hinged parabolic arch has a span 30 m and a rise of 7.5 m. The moment of inertia of arch section is proportional to $\sec\theta$. Where θ is the slope of the arch axis at any point with the horizontal. Calculate the horizontal thrust caused in the arch due to a rise of temperature 25°F. The value of $E = 2 \times 10^8$ kN/m^2 and coefficient of linear expansion = 6×10^{-6} per degree F. The moment of inertia at crown is 1.25×10^{-2} m^4.

(1) 2.5 kN
(2) 51.5 kN
(3) 21.5 kN
(4) 12.5 kN

63. A truss member AB is inclined at an angle α to X-axis (Global axis), then stiffness coefficient along local Y-axis will be, _____ ($\alpha + \beta = 90°$).

(1) $EA/l \cdot \cos\alpha \cdot \cos\beta$
(2) $EA/l \cdot \cos^2\alpha$
(3) $EA/l \cdot \cos^2\beta$
(4) 0

64. Systematic development of consistent deformation method has led to _____ matrix method.

(1) Flexibility
(2) Stiffness
(3) Slope deflection
(4) Three moment

65. The maximum sag or dip of the cable varies from _____, where L = horizontal span.

(1) $\frac{L}{2}$ to $\frac{L}{5}$
(2) $\frac{L}{5}$ to $\frac{L}{10}$
(3) $\frac{L}{10}$ to $\frac{L}{15}$
(4) $\frac{L}{15}$ to $\frac{L}{20}$

कच्च्या कामासाठी जागा / SPACE FOR ROUGH WORK

66. A continuous beam ABCD has fixed support at A, roller support at B, spring support at C and guided support at D. What should be the size of stiffness matrix after imposing boundary conditions ?

(1) 1×1 (2) 2×2

(3) 3×3 (4) 4×4

67. In a beam AB, when unit rotation is applied at near end A of the beam, then stiffness along y-axis at the far end B of the beam, is

(1) $4EI/l$ (2) $6EI/l^2$ (3) $-6EI/l^2$ (4) $12EI/l^3$

68. When an inclined or horizontal member is carrying mainly axial loads, it is termed as a

(1) Strut (2) Column

(3) Tie (4) All of the above

69. The span to overall depth ratio for two-way continuous slab of shorter span up to 3.5 m and loading class up to 3 kN/m^2 with high strength deformed bars of grade Fe415 is

(1) 26 (2) 32

(3) 35 (4) 40

70. What is the maximum diameter of main reinforcement used in case of slab of overall thickness 160 mm ?

(1) 10 mm (2) 12 mm (3) 16 mm (4) 20 mm

71. According to IS 456 : 1978 the thickness at the edge, in reinforced concrete footings shall not be less than _____ for footings on soils.

(1) 100 mm (2) 150 mm

(3) 250 mm (4) 350 mm

कच्च्या कामासाठी जागा / SPACE FOR ROUGH WORK

72. The intensity of soil pressure distribution at the toe should be _____ and at the heel should be _____ in case of analysis of cantilever T-shapped retaining wall.

(1) Equal to S.B.C. ; Tensile

(2) Less than S.B.C. ; Tensile

(3) Greater than S.B.C. ; Compressive

(4) Less than S.B.C. ; Compressive

73. In the design of two-way slab, maximum bending moment calculated depending on type of panel, apply only to _____ and no redistribution shall be made.

(1) Middle strips at bottom

(2) Edge strips at bottom

(3) Middle strips at top

(4) Edge strips at top

74. As per IS 456-2000, splices in flexural members should not be at sections where bending moment is _____ of the moment of resistance and not more than _____ shall be spliced at a section.

(1) More than 25%, two bars

(2) More than 33%, half the bars

(3) More than 50%, half the bars

(4) More than 67%, two bars

75. In the analysis of multistoreyed building frame, which method is used to calculate bending moments in beams and columns approximately for vertical loads (dead load and live load) only ?

(1) Cantilever method

(2) Portal method

(3) Substitute frame method

(4) Seismic co-efficient method

76. The diameter of longitudinal bars in a column should not be less than

(1) 4 mm

(2) 8 mm

(3) 12 mm

(4) 16 mm

कच्च्या कामासाठी जागा / SPACE FOR ROUGH WORK

77. Effective span of stair without stringer beam where spanning on the edge of the landing slab which span parallel to the risers will be _____ if going distance (G) = 2.75 m, width of landing (2x) = 1.5 m and width of passage (2y) = 2.5 m as per I.S. 456-2000 guidelines.

(1) 4.75 m (2) 4.50 m

(3) 5.0 m (4) 6.625 m

78. In working stress method, for concrete, modular ratio, m = _____/$(3 \times \sigma_{cbc})$.

(1) 285 (2) 284

(3) 280 (4) 289

79. The ratio of lateral strain to linear strain is known as

(1) Modulus of elasticity

(2) Modulus of rigidity

(3) Poisson's ratio

(4) Elastic limit

80. If modulus of elasticity (E) and modulus of rigidity (G) for a certain material are known then Poisson's ratio of a bar is calculated using relationship as

(1) $\mu = \frac{E}{2G} - 1$ (2) $\mu = \frac{2E}{G} - 1$

(3) $2\mu = \frac{E}{G} - 1$ (4) $\mu = \frac{3E}{2G} - 3$

81. A solid metal rod of uniform diameter D and length L is hung vertically from ceiling. If the density of the rod material is 1 and modulus of elasticity is E, then total elongation of the rod due to its own weight will be

(1) $L/2E$ (2) $L^2/2E$

(3) $E/2L$ (4) $E/2L^2$

कच्च्या कामासाठी जागा / SPACE FOR ROUGH WORK

82. The SFD of a cantilever beam of length l and carrying uniformly distributed load of 'w' per unit length will be

(1) a right angled triangle
(2) an isoceles triangle
(3) an equilateral triangle
(4) a rectangle

83. If a simply supported beam is subjected to U.D.L., 'W' over entire span 'L' then the bending stress at a point is directly proportional to

(1) Its distance from the neutral axis
(2) Section modulus
(3) Cross sectional area
(4) Moment of inertia

84. A cantilever beam of span L is subjected to two point loads, one at free end while other at centre of span. If intensity of both loads is same (W) then deflection at free end will be _____. Assume EI as constant.

(1) $7\ WL^3/2\ EI$
(2) $7\ WL^3/3\ EI$
(3) $7\ WL^3/8\ EI$
(4) $7\ WL^3/16\ EI$

85. The percentage increase in crippling load of long column, when the support condition of column as one end fixed and other end hinged is changed to both ends fixed, will be

(1) 200%
(2) 400%
(3) 50%
(4) 1600%

86. A mild steel rod is subjected to a axial force of 100 kN over a length of 200 mm. If the rod is elongated by 0.25 mm then what is the cross sectional area of rod ? Take $E = 2\times10^5$ MPa.

(1) $100\ mm^2$
(2) $200\ mm^2$
(3) $400\ mm^2$
(4) $800\ mm^2$

कच्च्या कामासाठी जागा / SPACE FOR ROUGH WORK

87. Consider a rectangular body of uniform c/s area and unit thickness subjected to a direct tensile stress (σ) along X – X axis. If an oblique section inclined with X – X axis at 45° and σ = 150 MPa then shear stress across the section is

(1) 50 MPa (2) 75 MPa

(3) 100 MPa (4) 150 MPa

88. In a simply supported beam, if the same load instead of concentrated at centre is distributed uniformly throughout the length, then the deflection at the centre will be reduced by

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

(3) $\frac{5}{8}$ times (4) $\frac{3}{8}$ times

89. A solid circular shaft is used to transmit power from one pulley to another. If 'τ' is maximum allowable shear stress and G is the shear modulus then maximum strain energy stored in the shaft is _____ consider 'V' is the volume of shaft.

(1) $\frac{\tau^2}{4G} \times V$ (2) $\frac{\tau^2}{2G} \times V$

(3) $\frac{\tau^2}{3G} \times V$ (4) $\frac{2\tau}{3G} \times V$

90. In the absence of reliable past performance date, the equipment's optimum output, which can be derived from manufacturer's manual is given by

(1) Optimum output = Ideal output × Correction factor

(2) Optimum output = Load per cycle × Cycles per hour

(3) Optimum output = Correction factor × Performance factor

(4) Optimum output = Digging effort × Soil factor

91. Accomplishment of quality through three quality trilogy, such as quality planning, quality control and quality improvement was the contribution of

(1) Kaoru Ishikawa (2) William Edwards Deming

(3) Joseph Juran (4) Walter A. Shewhart

92. The following material handling crane is not a mobile type of crane category

(1) Crawler-mounted crane
(2) Self-propelled crane
(3) Strut-jib crane
(4) Gantry crane

93. The following operation research technique most suitable for material procurement to minimize costs and time is

(1) Make or Buy Decision
(2) Queuing Problem
(3) Economic Order Quantity
(4) Linear Programming

94. Which are some of Indian pieces of legislation governing health and safety ?

a. Building and Other Construction Workers Act, 1966.
b. ISO 14000.
c. Factories Act, 1948.
d. M.R.T.P. Act, 1966

Answer Options :

(1) All of the above
(2) Only a
(3) a and c
(4) a, c and d

95. When the available time for an activity is equal to the activity duration, with no freedom of action, it is called as

(1) Sub-critical activity
(2) Super-critical activity
(3) Critical activity
(4) Special activity

96. If (A) is ordering cost, (C) is unit cost of an item, (D) is annual demand and (I) is inventory carrying charges p.a., then Economic Order Quantity (E.O.Q.) is equal to

(1) $\sqrt{\frac{2\times C\times A}{I\times D}}$
(2) $\sqrt{\frac{2\times A\times D}{I\times C}}$
(3) $\sqrt{\frac{2\times I\times C}{A\times D}}$
(4) $\sqrt{\frac{2\times C\times D}{I\times A}}$

कच्च्या कामासाठी जागा / SPACE FOR ROUGH WORK

97. The critical path of a network is

(1) Longest path with zero total float

(2) Longest path with positive total float

(3) Shortest path with negative total float

(4) None of the above

---

98. Line of Balance (LOB) is a planning technique that can be effectively applied for the project which involves

(1) Less number of resources

(2) Multi-disciplinary complex activities

(3) Repetitive activities

(4) Less number of activities

---

99. In materials management, the policy guidelines for selective control, as per 'ABC' analysis for 'A', 'B' and 'C' items is

(i) Degree of control.

(ii) Quantity forecast accuracy.

(iii) Authority for ordering purchase.

(iv) Safety stock.

Answer Options :

(1) B items (i) – Moderate, (ii) – Approx, (iii) – Middle level, (iv) – Adequate

(2) C items (i) – Strict, (ii) – Adequate, (iii) – Senior most, (iv) – Low

(3) A items (i) – High, (ii) – Accurate, (iii) – Senior level, (iv) – Low

(4) A items (i) – Loose, (ii) – Rough, (iii) – Junior level, (iv) – Adequate

---

100. Which among the following equipment is not suitable for carrying out excavation in hard soil or rock ?

(1) Power Shovel (2) Back Hoe

(3) Clam Shell (4) Jack Hammer

कच्च्या कामासाठी जागा / SPACE FOR ROUGH WORK P.T.O.

सूचना - (पृष्ठ 1 वरून पुढे.....)

(8) प्रश्नपुस्तिकेमध्ये विहित केलेल्या विशिष्ट जागीच कच्चे काम (रफ वर्क) करावे. प्रश्नपुस्तिकेव्यतिरिक्त उत्तरपत्रिकेवर वा इतर कामदावर 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 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 प्रश्न-क्रमांकासमोरील 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