महाराष्ट्र अभियांत्रिकी (स्थापत्य) सेवा मुख्य परीक्षा - २०१२

परीक्षा दि : १५ व १६ डिसेंबर, २०१२

प्रश्नपुस्तिका क्रमांक
BOOKLET No.

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प्रश्नपुस्तिका

स्थापत्य अभियांत्रिकी
पेपर – I

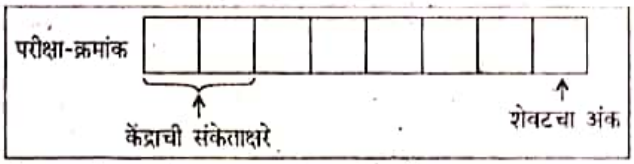
वेळ : 2 (दोन) तास

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. असा 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.

(7) **प्रस्तुत परीक्षेच्या उत्तरपत्रिकांचे मूल्यांकन करताना उमेदवाराच्या उत्तरपत्रिकेतील योग्य उत्तरांनाच गुण दिले जातील. तसेच ''उमेदवाराने वस्तुनिष्ठ बहुपर्यायी स्वरूपाच्या प्रश्नांची अचूक उत्तरेच उत्तरपत्रिकेत नमूद करावीत. अन्यथा त्यांच्या उत्तरपत्रिकेत सोडविलेल्या प्रत्येक चार चुकीच्या उत्तरांसाठी एका प्रश्नाचे गुण वजा करण्यात येतील''.**

पर्यवेक्षकांच्या सूचनेविना हे सील उघडू नये

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

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1. In Residential building, kitchen should have _____ aspect.
   (1) Eastern (2) Southern (3) South-Eastern (4) Northern

2. Workability of concrete can be measured by
   (1) Slump test (2) Compaction factor test
   (3) Kelly ball test (4) All the above

3. For a rectangular room, better proportion is to adopt length as _____ times of breadth.
   (1) 1 to 1·2 (2) 1·2 to 1·7 (3) 1·2 to 1·5 (4) 1·5 to 1·7

4. The laboratory slump test result of the fresh concrete is between 25 – 50 mm. The degree of workability of such concrete is
   (1) very low (2) low (3) medium (4) high

5. Black cotton soil is a product of decomposition of
   (1) Granite (2) Marble
   (3) Basalt (4) Sandstone

6. The strength achieved by a brick depends on
   (1) composition of brick earth (2) nature of moulding adopted
   (3) burning and cooling process (4) All the above

7. Capacity of concrete to bear imposed stresses safely is called as
   (1) Compressive strength (2) Shear strength
   (3) Durability (4) Resistance

8. State whether the following statements are true or false :
   a. Consistency test is used to determine the percentage of water required for preparing cement paste.
   b. Vicat Apparatus is used for determining the consistency of cement.
   (1) a true, b true (2) a false, b false
   (3) a true, b false (4) a false, b true

SPACE FOR ROUGH WORK

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9. Durability of construction material is

(1) Resistance to crushing (2) Resistance to weathering

(3) Shear strength (4) Compressive strength

10. Seasoning of timber means

(1) removing the moisture content (2) reducing weight of timber

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

11. _____ is the quantity of fine aggregate required per 50 kg of cement of M 150 – 1 : 2 : 4 grade of concrete.

(1) 0·340 kg (2) 0·053 kg

(3) 0·035 kg (4) 0·070 kg

12. Artificial method of seasoning timber is

(1) boiling (2) chemical seasoning

(3) water seasoning (4) All of the above

13. Laterite is used in

(1) carving and ornamental works (2) fire resistance works

(3) electrical switchboards (4) heavy engineering works

14. In medium carbon steel, carbon content varies from

(1) 0·25% to 0·60% (2) 0·10% to 0·25%

(3) 0·60% to 0·75% (4) 0·75% to 1·00%

15. Light weight concrete is also known as

(1) low concrete (2) lean concrete

(3) transparent concrete (4) cellular concrete

16. The process of tempering is applied to steel in hardening process for improving

(1) ductility (2) strength

(3) roughness (4) All of the above

SPACE FOR ROUGH WORK

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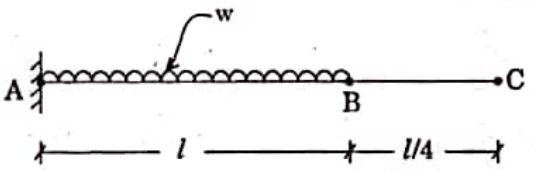
17. A cantilever beam 'AC' of uniform cross-section carries a uniformly distributed load over the portion 'AB' of length 'l' as shown. Slope at free end 'C' will be



(1) $\frac{wl^3}{6\,EI}$ (2) $\frac{5\,wl^2}{96\,EI}$ (3) $\frac{5\,wl^3}{48\,EI}$ (4) $\frac{wl^2}{2\,EI}$

18. Shrinkage strain developed in post-tensioning beam when prestressing force transfer at the age of 't' days is

(1) $\frac{0{\cdot}003}{\log_{10}(t+2)}$ (2) $\frac{0{\cdot}002}{\log_{10}(t+2)}$ (3) $\frac{0{\cdot}0035}{\log_{10}(t+2)}$ (4) $\frac{0{\cdot}001}{\log_{10}(t+1)}$

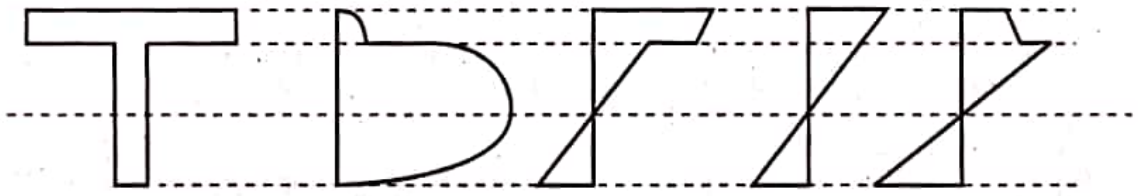
19. The _____ at any section in a given beam is equal to _____ at corresponding section in conjugate beam.

(1) slope, shear force (2) deflection, shear force
(3) slope, bending moment (4) slope, deflection

20. A beam of span 'L' carries a U.D.L. of 'w' per m run and prestressing force in the cable is 'P'. What will be the eccentricity of parabolic cable at centre (i.e. dip) so as to nullify the bending effect ?

(1) $\frac{3\,L^2}{3\,P}$ (2) $\frac{3\,wL^2}{5\,P}$ (3) $\frac{wL^2}{8\,P}$ (4) $\frac{wL^3}{8\,P}$

21. A cast iron beam is a T-section as shown. It is supported and carrying a uniformly distributed load. Which of the following is the correct bending stress distribution diagram if the element is stressed perfectly within plastic limit ?



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

22. In pretensioned system, when prestressed force is transferred by releasing tendon, the end of wire swells and develops wedge effect. At the end, prestressing force becomes zero. This is known as

(1) Hoyer effect (2) Shear effect
(3) Wobbling effect (4) Bursting effect

SPACE FOR ROUGH WORK

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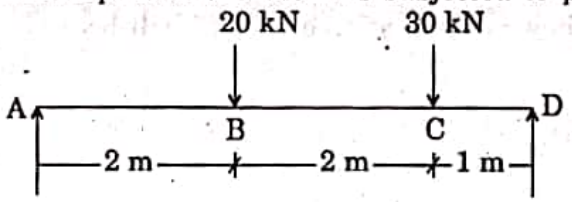
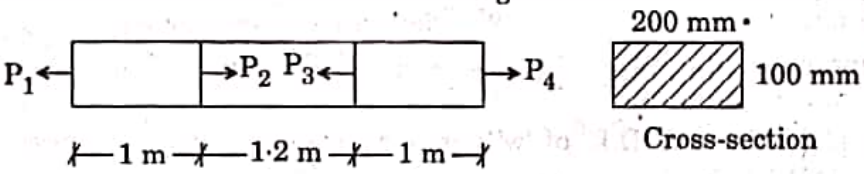
23. Which part of the beam is subjected to pure bending in the following figure ?



(1) AB
(2) BC
(3) CD
(4) No part of beam is subjected to pure bending

24. Progressive increase in the inelastic deformation of concrete under sustained stress component is known as
(1) Shrinkage of concrete (2) Creep of concrete
(3) Deformation of concrete (4) Yielding of concrete

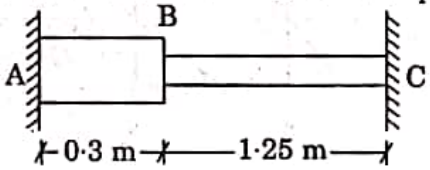
25. Calculate the maximum stress acting on the cross-section of following element :



Take P_1 = 45 kN, P_2 = 445 kN and P_4 = 130 kN.
(1) 20 N/mm^2 (2) 22·5 N/mm^2 (3) 28·75 N/mm^2 (4) 6·5 N/mm^2

26. What are the stresses developed at the top and bottom of a rectangular beam subjected to prestressing force of 50 kN at a distance of 50 mm from bottom. The c/s of beam is 100 × 100 mm.
(1) (5, 5) (2) (20, 10) (3) (5, 10) (4) (10, 5)

27. At room temperature the rods are shown in figure. When temperature is raised, what is the nature of stresses developed in each rod, if $E_{Al} < E_s$ and $\alpha_{Al} > \alpha_s$?



Supports are unyielding

(1) Compressive in aluminium and steel
(2) Tensile in aluminium and steel
(3) Compressive in aluminium and tensile in steel
(4) Tensile in aluminium and compressive in steel

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28. The prestressed concrete is considered as a combination of steel and concrete, with steel taking tensile force passing through the tendon and concrete taking compressive force passing through the C.G. of stress distribution so that the two materials form a resisting couple to resist external moment. This concept is called as

(1) strength concept
(2) stress concept
(3) load balancing concept
(4) moment concept

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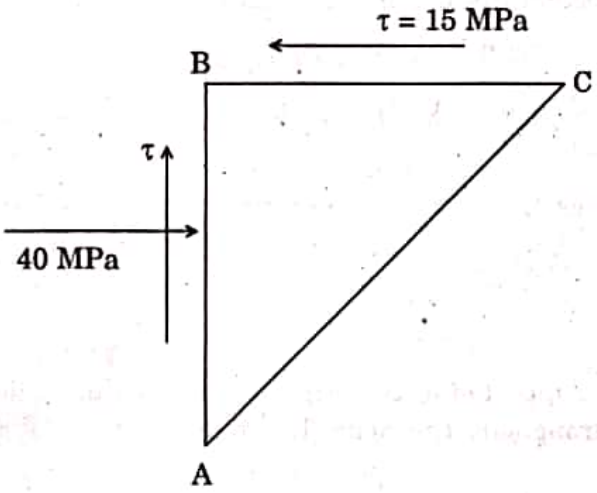
29. If AC is principal plane, then magnitude of principal tensile stresses will be



(1) 15 MPa
(2) 5 MPa
(3) 45 MPa
(4) Zero

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30. In a post-tensioning system, high tension steel wires 5 mm to 8 mm diameter about 12 in number are arranged to form a group into a cable with a spiral spring inside. This system is known as

(1) The Freyssinet System
(2) The Magnel Blaton System
(3) P.S.C. Monowire System
(4) C.C.L. Standard System

SPACE FOR ROUGH WORK

P.T.O.

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31. A simply supported beam subjected to uniformly varying load of intensity W at left end (A) reduces to zero at right end (B). Then slope at end B is

(1) $\frac{5\,WL^3}{360\,EI}$ (2) $\frac{9\,WL^3}{360\,EI}$ (3) $\frac{3\,WL^3}{360\,EI}$ (4) $\frac{7\,WL^3}{360\,EI}$

32. If a moment is applied to the hinged end of a prismatic propped cantilever, then the moment at the fixed end will be

(1) M (2) M/2 (3) M/3 (4) M/4

33. A single concentrated load W rolling over the beam of span L will cause the maximum bending moment and shear force on a section X at a distance x from left support. When the load is on the section, its maximum bending moment will be

(1) $wxL^2/(L - x)$ (2) $wx\,(L - x)/L$

(3) $wx^2(L - x)/L^2$ (4) $WL(L - x)/L$

34. Maximum number of unknown forces that can be determined in concurrent force system under equilibrium is

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

35. A beam fixed at one end and simply supported at the other end is carrying uniformly distributed load of intensity 'w' throughout the span L. Then reaction at simply supported end is

(1) $\frac{5}{8}$ wL (2) $\frac{3}{8}$ wL (3) $\frac{8}{5}$ wL (4) $\frac{3}{2}$ wL

36. A two span continuous beam having equal spans each of length l is subjected to u.d.l. of w per unit run over the whole beam. The beam has constant EI. The bending moment at the middle support is

(1) $wl^2/4$ (2) $wl^2/8$

(3) $wl^2/12$ (4) $wl^2/16$

37. A beam fixed at one end and free at the other end is subjected to U.D.L. of intensity 'w' over the entire span 'L'. Then the deflection at free end will be

(1) $wL^4/8\,EI$ (2) $wL^3/3\,EI$

(3) $wL^2/8\,EI$ (4) $wL^4/3\,EI$

SPACE FOR ROUGH WORK

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38. A two span continuous beam having equal spans each of length l is subjected to u.d.l. w per unit length. The beam has constant EI. The reaction at the middle support is

(1) wl (2) $5\,wl/2$ (3) $5\,wl/4$ (4) $5\,wl/8$

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39. A cable is supported at both ends at the same level and is subjected to U.D.L. over the entire span. If y_c is the central dip and 'l' is the span of a cable, then horizontal thrust developed at the support is

(1) $wl^3/8y_c$ (2) $wl^2/3y_c$ (3) $wl^2/8y_c$ (4) $wl^2/2y_c$

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40. U_1 and U_2 are the strain energies stored in a prismatic bar due to axial tensile forces P_1 and P_2 respectively. The strain energy U stored in the same bar due to combined action of P_1 and P_2 will be

(1) $U = U_1 + U_2$ (2) $U = U_1 \times U_2$

(3) $U < U_1 + U_2$ (4) $U > U_1 + U_2$

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41. "The bending moment at any point of an arch axis is proportional to the vertical intercept between the theoretical arch" is the statement of

(1) Mohr's theorem (2) Eddy's theorem

(3) Castigliano's theorem (4) Theorem of least work

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42. A three-hinged symmetrical parabolic arch is subjected to a u.d.l. of w per unit run over the whole span. Then the bending moment is zero at

(1) supports (2) quarter spans

(3) crown (4) All the three above

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43. When one of the supports of a beam is at a lower level as compared to the other, it will cause a moment at both ends. The magnitude of this moment introduced in slope deflection equation is

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

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44. A two-hinged parabolic arch is subjected to u.d.l. w over entire span. Then the horizontal thrust is

(1) $wl^2/3h$ (2) $wl^2/4h$

(3) $wl^2/6h$ (4) $wl^2/8h$

SPACE FOR ROUGH WORK

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45. The distance between rivet centers measured along transverse to the direction of force is

(1) Gauge (2) Pitch

(3) End distance (4) Maximum pitch

46. Determine the rivet value of 20 mm diameter rivets connecting 12 mm thick plate if it is in single shear. Gross area of rivet is 363·05 mm^2, permissible stresses in shear and bearing are 80 MPa and 250 MPa respectively.

(1) 64·5 kN (2) 645 kN

(3) 29·044 kN (4) 290·44 kN

47. The effective length of fillet weld of length 200 mm and size 12 mm is

(1) 188 mm (2) 176 mm (3) 388 mm (4) 200 mm

48. The type of weld used for joining two surfaces approximately at right angles to each other is known as

(1) Butt weld (2) U groove weld

(3) V groove weld (4) Fillet weld

49. The net effective cross-sectioned area of a single angle section connected by one leg to the gusset plate is

(1) $\frac{3A_1}{3A_1 + A_2}$ (2) $\frac{5A_1}{5A_1 + A_2}$ (3) $\frac{3A_1}{3A_1 - A_2}$ (4) $\frac{5A_1}{5A_1 - A_2}$

50. The effective length of compression steel column of length 'L' which is effectively held in position at both ends but not restrained against rotation is

(1) 0·65 L (2) 0·8 L (3) L (4) 1·5 L

51. The axial force in each lacing in double lacing system is

(1) $\frac{V}{4n \sin \theta}$ (2) $\frac{V}{2n \sin \theta}$

(3) $\frac{V}{n \sin \theta}$ (4) $\frac{2V}{n \sin \theta}$

SPACE FOR ROUGH WORK

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52. The beam is subjected to U.D.L. of 41·25 kN/m. Effective span of beam is 8 m. Find section modulus for the section. Assume σ_{bc} = 165 MPa.

(1) 2×10^6 mm^3 (2) 2×10^3 mm^3

(3) $2{\cdot}5 \times 10^6$ mm^3 (4) $2{\cdot}5 \times 10^3$ mm^3

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53. What is the effective length of beam if compression flange is restrained fully against lateral bending, as per IS 800 : 200 ?

(1) L (2) 0·8 L (3) 0·85 L (4) 0·7 L

---

54. As per IS 800 : 1984, the thickness of slab base is

(1) $\frac{3w}{\sigma_{bs}}\left(a^2 - \frac{b^2}{4}\right)$ (2) $\frac{3w}{\sigma_{bs}}\left(\frac{a^2 - b^2}{4}\right)$

(3) $\sqrt{\frac{3w}{\sigma_{bs}}\left(a^2 - \frac{b^2}{4}\right)}$ (4) $\sqrt{\frac{3w}{\sigma_{bs}}\left(\frac{a^2 - b^2}{4}\right)}$

---

55. Intermediate vertical stiffners are required in plate girder when d/t_w ratio of the web exceeds

(1) 85 (2) 80 (3) 90 (4) 75

---

56. In plate girder, flanges are designed to resist

(1) Shear force (2) Bending moment

(3) Axial force (4) Torsional moment

---

57. The flange splice in plate girder should be selected at

(1) maximum shear location (2) minimum shear location

(3) maximum moment location (4) minimum moment location

---

58. Structural members of the truss which are supported on the principal rafter and which run transverse to the truss are called

(1) Rafters (2) Purlins

(3) Sag tie (4) Struts

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59. The moment of resistance offered by balanced section in W.S.M. is given by (As per IS 456 – 2000)

(1) $\frac{1}{2} \cdot \sigma_{cbc} \cdot b \cdot x^2$ (2) $\frac{1}{2} \cdot \sigma_{cbc} \cdot b \cdot d^2$

(3) $\frac{1}{2} \cdot \sigma_{cbc} \cdot b \cdot d \cdot (1 - x/3)$ (4) $\frac{1}{2} \cdot \sigma_{cbc} \cdot b \cdot x \cdot (d - x/3)$

---

60. The compressive strength requirements of 53 grade O.P.C. cement as per IS 12269 – 1989 @ 3, 7 and 28 days in N/mm^2 are

(1) 33, 43, 53 (2) 27, 37, 53 (3) 33, 47, 53 (4) 27, 45, 53

---

61. In a rectangular beam of section b × d, subjected to ultimate torsional moment Tu, equivalent ultimate shear can be given as

(1) $Vu + 1{\cdot}6 \cdot \frac{Tu}{b}$ (2) $Vu + 1{\cdot}6 \cdot \frac{Tu}{bd}$

(3) $Vu + 2 \cdot \frac{Tu}{b}$ (4) $Vu + \frac{Tu}{2b}$

---

62. Area of footing of an axially loaded column subjected to working load of 1000 kN and safe bearing capacity of soil 250 kN/m^2, is

(1) 4·0 m^2 (2) 4·4 m^2 (3) 6·0 m^2 (4) 5·5 m^2

---

63. Minimum depth of foundation is calculated using Rankine's formula in which ϕ is the angle of repose, q_0 is the safe bearing capacity and γ is the unit weight of soil. The value is

(1) $\frac{q_0}{\gamma}\left(\frac{1 + \sin\phi}{1 - \sin\phi}\right)^2$ (2) $\frac{q_0}{\gamma}\left(\frac{1 - \cos\phi}{1 + \cos\phi}\right)^2$

(3) $\frac{q_0}{\gamma}\left(\frac{1 - \sin\phi}{1 + \sin\phi}\right)^2$ (4) $\frac{q_0}{\gamma}\left(\frac{1 + \cos\phi}{1 - \cos\phi}\right)^2$

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64. If a retaining wall is to be constructed to retain water of height 'H' and 'w' is unit weight of water, then water pressure acting on retaining wall will be

(1) $K_a wH^2/2$ (2) $K_p wH^2/2$

(3) $wH^2/2$ (4) wH^2

---

65. As per IS 456 : 2000, maximum bending moment at a support next to end support of a three span continuous beam having each span 'L' subjected to U.D.L. in the form of dead load (W_d) and live load (W_L) is given by

(1) $\frac{1}{10} W_d L^2 + \frac{1}{9} W_L L^2$ (2) $\frac{1}{9} W_d L^2 + \frac{1}{10} W_L L^2$

(3) $\frac{1}{10} W_d L^2 + \frac{1}{16} W_L L^2$ (4) $\frac{1}{12} W_d L^2 + \frac{1}{16} W_L L^2$

---

66. Area of torsional reinforcement provided in a two-way slab at corners where both adjacent edges are continuous is

(1) $\frac{3}{4} A_{st} x^+$ (2) $\frac{3}{4} A_{st} y^+$ (3) $\frac{3}{8} A_{st} x^+$ (4) 0

---

67. A singly reinforced rectangular section, b × d is effective c/s, f_{ck} and f_y are the characteristic strengths of concrete and steel respectively. The depth of neutral axis is calculated as

(1) $\frac{0{\cdot}85 f_{ck}\, bd}{f_y}$ (2) $\frac{0{\cdot}87 f_y A_{st}}{0{\cdot}36 f_{ck}\, bd}$ (3) $\frac{0{\cdot}87 f_y A_{st}}{0{\cdot}36 f_{ck}\, bd^2}$ (4) $\frac{0{\cdot}87 f_y A_{st}}{0{\cdot}36 f_{ck} .b}$

---

68. The maximum strain in steel at failure in limit state method of design is considered as

(1) $\frac{f_y}{1{\cdot}15 E_s} + 0{\cdot}002$ (2) $\frac{f_y}{1{\cdot}15 E_s} + 0{\cdot}0035$

(3) $\frac{f_y}{1{\cdot}5 E_s} + 0{\cdot}0035$ (4) $\frac{1{\cdot}5 f_y}{E_s} + 0{\cdot}002$

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69. In case of simply supported beam subjected to U.D.L. w throughout the span which develops maximum B.M. at the mid-span, the cracks formed during the failure of beam at mid-span are

(1) horizontal (2) inclined at 45°

(3) inclined at 60° (4) vertical

---

70. In a slab cast monolithically with cantilever beam, the beam is above the slab so as to give plain soffit. Then the beam is designed as

(1) Rectangular section (2) Flanged section

(3) Doubly reinforced section (4) None of the above

---

71. The load carrying capacity of a circular column with helical reinforcement is how much % more than that of column with lateral ties ?

(1) 5% (2) 10% (3) 15% (4) 20%

---

72. For the design of a staircase, if R is the riser, T is the tread and D is the thickness of waist slab, then the load of waist slab per m width of stair in plan will be

(1) $25\ D \times \left(\frac{T}{\sqrt{T^2 + R^2}}\right)$ (2) $25\ D \times \left(\frac{\sqrt{T^2 + R^2}}{T}\right)$

(3) $25\ D \times \left(\frac{R}{\sqrt{T^2 + R^2}}\right)$ (4) $25\ D \times \left(\frac{\sqrt{T^2 + R^2}}{R}\right)$

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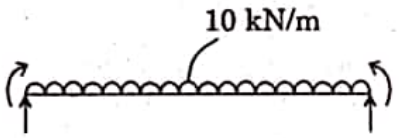
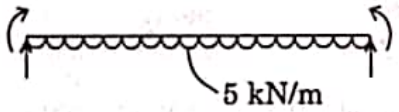
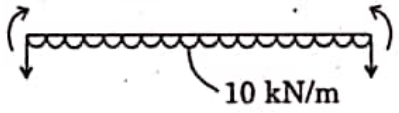
73. There is a post-tensioned prestressed concrete beam with effective simply supported span of 8 m. This beam with rectangular cross section is prestressed with parabolic cable with 200 kN force, having eccentricity 200 mm above neutral axis at mid-span and 200 mm below it at support. The cable can be replaced by an equivalent effect as

(1) 

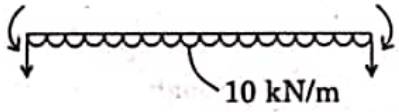
40 kN-m

(2) 

40 kN-m

(3) 

40 kN-m

(4) 

40 kN-m

---

74. Principal tensile stresses at any section and at any fiber in a prestressed concrete beam are influenced by

(1) Horizontal prestress in concrete (2) Vertical prestress in concrete
(3) Shear stress in concrete (4) All of the above

---

75. Effeciency of a rectangular prestressed concrete section with dimensions b = 0·5 d is

(1) bd (2) 0·5 bd (3) 0·5 (4) 0·333

---

76. Which of the following statements is/are true with reference to a load balancing cable ?

Statement I : The flexural stresses are uniform at any section throughout the span at service stage.

Statement II : The flexural stresses are zero in the extreme fibers at any section throughout the span at service stage.

Statement III : The shear stresses are zero at any section throughout the span at service stage.

(1) I only (2) I and III only
(3) II and III only (4) None of these

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77. As per IS 1343 – 1980, loss of prestress in steel due to shrinkage in concrete in a pre-tension beam is _____, if $E_s = 2 \times 10^5$ MPa.

(1) 60 MPa (2) 200 MPa

(3) 20 MPa (4) 0·02 f_s MPa

78. The net resultant stresses at bottom fiber of a section are zero means the resultant thrust must be passing from

(1) extreme top fiber (2) neutral axis

(3) upper kern point (4) lower kern point

79. In a post-tensioned prestressed concrete beam, jacking force is applied from one end only. The loss of stresses in steel due to friction between steel and surrounding material will be maximum at

(1) Jacking end

(2) Mid span

(3) Anchored end

(4) Loss of stresses in steel due to friction is uniform throughout the span

80. Minimum strength of concrete at transfer (f_{ci}), to avoid cracking of extreme fiber at a prestressed concrete beam with reference to limit state of servicability, maximum compression in flexure should be

(1) 0·7 $\sqrt{f_{ck}}$ (2) 0·5 f_{ck}

(3) 0·24 $\sqrt{f_{ck}}$ (4) f_{ck}

81. Vertical limits within which cable is to be provided in a post-tensioned prestressed concrete element is called as

(1) Anchorage zone (2) End block

(3) Transmission length zone (4) Safe cable zone

82. Minimum grade of concrete to be used for pre- and post-tension prestressed concrete construction are

(1) M30 and M40 respectively (2) M30 in both cases

(3) M40 in both cases (4) M40 and M30 respectively

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83. The resist bursting tension, designed reinforcement is distributed in the zone of _____ from the loaded face of the end block, where $2y_0$ is depth of equivalent prism.

(1) $0y_0$ to $2y_0$ (2) $0y_0$ to y_0

(3) $0{\cdot}2y_0$ to $2y_0$ (4) $0{\cdot}2y_0$ to y_0

84. What is the correct order of increase in ultimate moment of resistance of

I. Pre-tension section

II. Post-tension bonded section

III. Post-tension unbonded section,

keeping all other parameters same.

(1) I, II and III (2) III, II and I

(3) II, III and I (4) All sections will have same UMR

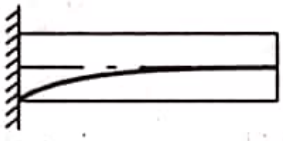
85. Deflection of a simply supported prestressed concrete beam of span 'l' and flexural rigidity 'EI', due to a straight cable carrying prestressing force 'P' and eccentricity 'e' below the neutral axis is

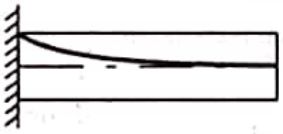
(1) $\frac{5\,Pel^2}{48\,EI}\uparrow$ (2) $\frac{Pel^2}{8\,EI}\downarrow$

(3) $\frac{Pel^2}{8\,EI}\uparrow$ (4) $\left(\frac{Pel^2}{8\,EI}+\frac{5\,Pel^2}{48\,EI}\right)\uparrow$

86. A cantilever beam of span 'L' is supporting a udl of intensity 'w'. Most suitable cable profile will be

(1) parabolic cable profile

(2)  parabolic cable profile

(3)  parabolic cable profile

(4) parabolic cable profile

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87. The shortcoming of bar chart is

(1) lack of degree of details (2) activity inter-relationship

(3) does not show progress of work (4) All the above

88. Among the following, who is considered as the father of scientific management ?

(1) Max Weber (2) Henry Fayol

(3) F.W. Taylor (4) Elton Mayo

89. Program Evaluation and Review Technique is used when

(1) repetitive type of work exists

(2) time estimation is uncertain

(3) time estimation is very easy

(4) cost optimization is of prime importance

90. Which of the following is the main contribution of scientific management ?

(1) A rational approach to solve organisation problem

(2) Development of principles of management

(3) Correlation between improved working conditions and high production

(4) All of the above

91. The sequence to be followed while developing the network diagram is

a. defining objectives

b. sequencing the activities

c. breaking down the structure

d. developing the relation between events

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

92. In what way does ABC analysis help the manager ?

(1) To purchase material at low price (2) To exercise selective control

(3) To purchase material very fast (4) To select good quality material

93. The optimistic time, pessimistic time and most likely time required for completion of activity is 4, 11 and 6 days respectively. The expected time is

(1) 5 days (2) 6 days

(3) 5·5 days (4) 6·5 days

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94. Which of the following is the formula for Economic Order Quantity if M is annual demand, C_o is ordering cost, C_c is inventory carrying cost and S is unit price of an item ?

(1) $EOQ = \sqrt{\frac{2MC_o}{SC_c}}$ (2) $EOQ = \sqrt{\frac{MC_oC_c}{2S}}$

(3) $EOQ = \sqrt{\frac{MC_c}{SC_o}}$ (4) $EOQ = \sqrt{\frac{2MS}{C_oC_c}}$

---

95. The optimistic time, pessimistic time and most likely time required for completion of an activity is 4, 8 and 6 days respectively. The variance of time estimate is

(1) 0·4356 (2) 0·450 (3) 0·400 (4) 0·500

---

96. Which of the following Acts specially covers safety legislation of construction industry in India ?

(1) Contract Labour Act
(2) Workmen's Compensation Act
(3) Inter State Migrant Workers Act
(4) There is no safety legislation oriented to construction industry

---

97. Most of the accidents in construction industry happen due to

(1) lack of education and training (2) negligence and ignorance
(3) Both (1) and (2) (4) None of the above

---

98. CPM network is

(1) Activity oriented (2) Event oriented
(3) Labour oriented (4) Money oriented

---

99. The fire safety requirements of the building are designed as per

(1) IS 1645 – 1960 (2) IS 1256 – 1967
(3) IS 1647 – 1960 (4) IS 1646 – 1960

---

100. Optimum duration of project corresponds to which of the following ?

(1) Direct project cost (2) Indirect project cost
(3) Crash project cost (4) Total project cost

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परीक्षेचे नांव: महाराष्ट्र अभियांत्रिकी सेवा (स्थापत्य), गट- ब (मुख्य)- परीक्षा -२०१२ परीक्षेचा दिनांक: १५ व १६ डिसेंबर,२०१२
विषय :(प्रश्नपत्रिका क्र.२) स्थापत्य अभियांत्रिकी - पेपर क्र.१

महाराष्ट्र अभियांत्रिकी सेवा (स्थापत्य), गट- ब (मुख्य) परीक्षा - २०१२ या स्पर्धा परीक्षेच्या प्रश्नपत्रिकेची उत्तरतालिका उमेदवारांच्या माहितीसाठी संकेतस्थळावर प्रसिध्द करण्यात आली होती. त्यासंदर्भात उमेदवारांनी अधिप्रमाणित (Authentic) स्पष्टीकरण / संदर्भ देऊन पाठविलेली लेखी निवेदने, तसेच तज्ज्ञांचे अभिप्राय विचारात घेऊन आयोगाने उत्तरतालिका सुधारित केली आहे. या उत्तरतालिकेतील उत्तरे अंतिम समजण्यात येतील. यासंदर्भात आलेली निवेदने विचारात घेतली जाणार नाहीत व त्याबाबत कोणताही पत्रव्यवहार केला जाणार नाही, याची कृपया नोंद घ्यावी.

उत्तरतालिका

प्रश्न क्रमांक	उत्तरे			
	संच A	संच B	संच C	संच D
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3	3	4	1	2
4	2	4	1	1
5	3	1	1	4
6	4	1	4	4
7	1	4	3	1
8	1	4	2	1
9	2	1	1	1
10	1	4	1	1
11	4	3	4	1
12	4	2	4	4
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20	3	1	1	1
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22	1	1	1	1
23	4	2	3	1
24	2	1	3	4
25	1	1	1	2

प्रश्न क्रमांक	उत्तरे			
	संच A	संच B	संच C	संच D
26	1	2	4	1
27	1	1	2	1
28	1	3	1	1
29	2	3	1	1
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45	1	1	4	1
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48	4	1	2	2
49	1	2	1	1
50	3	4	3	4

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प्रश्न क्रमांक	उत्तरे			
	संच A	संच B	संच C	संच D
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73	3	1	3	4
74	4	3	2	2
75	4	3	3	3

प्रश्न क्रमांक	उत्तरे			
	संच A	संच B	संच C	संच D
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98	1	1	4	2
99	2	2	3	1
100	4	4	1	1

date - 18th January, 2013

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महाराष्ट्र अभियांत्रिकी (स्थापत्य) सेवा मुख्य परीक्षा - २०१२

प्रश्नपुस्तिका क्रमांक
BOOKLET No.

2012 **Code : V01**

परीक्षा दि : १५ व १६ डिसेंबर, २०१२

3213?

A

प्रश्नपुस्तिका

स्थापत्य अभियांत्रिकी
पेपर – II

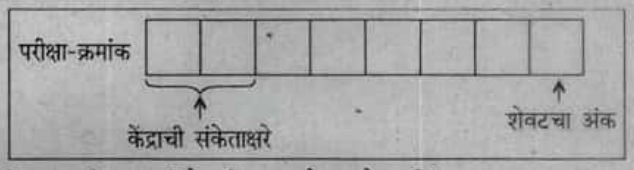
वेळ : 2 (दोन) तास

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. असा 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.

(7) **प्रस्तुत परीक्षेच्या उत्तरपत्रिकांचे मूल्यांकन करताना उमेदवाराच्या उत्तरपत्रिकेतील योग्य उत्तरांनाच गुण दिले जातील. तसेच "उमेदवाराने वस्तुनिष्ठ बहुपर्यायी स्वरूपाच्या प्रश्नांची अचूक 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 प्रजलित 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

SEAL

पर्यवेक्षकांच्या सूचनेविना हे सील उघडू नये

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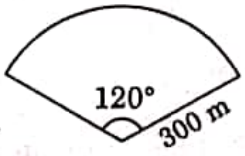
1. A survey which consists of observations of the heavenly bodies such as Sun or any fixed star, is known as

(1) Celestial Survey (2) Astrological Survey

(3) Heaven Survey (4) Astronomical Survey

---

2. If the radius of simple circular curve is 300 m and intersection angle between two straight lines is 120°, the tangent length of curve is



(1) 173·105 m (2) 174·305 m

(3) 173·205 m (4) 175·050 m

---

3. In the change point procedure, change point is the point of

(1) the initial position of dumpy level.

(2) the portion of staff where instrument is shifted.

(3) the final position of dumpy level.

(4) None of the above

---

4. The process of establishing number of intermediate points between two fixed end points on ground is known as

(1) Ranging (2) Offsets

(3) Station points (4) Auxiliary points

---

5. The latitude of a line of closed traverse is its length multiplied by

(1) tangent of reduced bearing (2) sine of reduced bearing

(3) cosine of reduced bearing (4) secant of reduced bearing

---

6. When lines come close together in a contour map, it indicates

(1) Hill (2) Reservoir

(3) Steep slope (4) Flat slope

SPACE FOR ROUGH WORK

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7. In geodetical observations, the correction for refraction is
   (1) subtractive to both the angle of elevation and the angle of depression
   (2) additive to both the angle of elevation and the angle of depression
   (3) subtractive to the angle of elevation and additive to the angle of depression
   (4) additive to the angle of elevation and subtractive to the angle of depression

8. A road section of length 2 km scales 9 cm on a vertical photograph. The focal length of the camera is 180 mm. If the terrain is fairly level, then the flying height will be
   (1) 40 m (2) 4000 m
   (3) 40 km (4) 400 km

9. The process of determining the location of the station (on the map) occupied by the plane table is
   (1) Intersection (2) Two-point problem
   (3) Resection (4) Traversing

10. The area of irregular plotted figure can be easily determined by using instrument named as
   (1) Pentagraph (2) Planimeter
   (3) Subtense bar (4) Vernier

11. In case of a truly vertical photographic survey, which of the following points coincide ?
   I. Principal point
   II. Isocentre
   III. Plumb point
   (1) I and II only (2) I and III only
   (3) II and III only (4) I, II and III

12. Measurement of discharge of river usually forms a part of
   (1) Topographic surveying (2) Hydrographic surveying
   (3) Geodetic surveying (4) Route surveying

13. A total station is an instrument consisting of the combination of
   (1) prismatic compass, theodolite and dumpy level
   (2) auto level, tacheometer and compass
   (3) electronic theodolite and electronic distance meter
   (4) digital planimeter with auto level

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14. The most reliable estimate is

(1) Detailed estimate (2) Preliminary estimate

(3) Plinth area estimate (4) None of these

---

15. While computing masonry work, no deductions are generally made for

(1) opening each up to 0·10 sq. m

(2) ends of beam up to 0·05 sq. m

(3) bed plates and wall plates up to 10 cm

(4) All the above

---

16. The estimated quantity of cement required per m^3 in a compacted cement concrete of 1 : 2 : 4 nominal mix is

(1) 305 kg (2) 330 kg

(3) 285 kg (4) 255 kg

---

17. Identity correct statements from the following :

a. Centre line method is the most common method for calculating the quantities of walls.

b. Centre line method is suitable for determining quantities of walls which are curved in plan.

c. Out-to-out and in-to-in method is the most common method for calculating quantities of walls.

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

(3) a only (4) b and c

---

18. Annual income from a property is ₹ 25,000. The capitalized value of this property for a prevailing rate of 12·5% interest is

(1) ₹ 5,00,000 (2) ₹ 2,00,000

(3) ₹ 2,50,000 (4) ₹ 3,12,000

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19. A property whose owner is in the absolute possession of the property, and the owner can utilise the same in any manner he likes subject to the rules and regulations of Govt. and local authorities is known as

(1) Leasehold property (2) Saleable property

(3) Freehold property (4) Absolute property

---

20. Which of the following documents will ***not*** be required for drafting the tender notice ?

(1) Nature of work and its location

(2) Estimated cost of the work

(3) Mode of submitting tender

(4) Schedule 'A' of the proposed work

---

21. In case of beams, the ratio of breadth to depth is usually taken as

(1) 0·5 to 0·7 (2) 0·9 to 1·0

(3) 1·2 to 1·4 (4) 1·8 to 2·0

---

22 *Assertion (A) :* Rate analysis is carried out to work out the actual cost of the structure or building.

Reason (R) : Rate analysis is carried out to revise the schedule of rates.

State whether

(1) Both A and R are true (2) A is true and R is false

(3) A is false and R is true (4) Both A and R are false

---

23. Which value of asset will fetch more money from market ?

(1) Distress value (2) Monopoly value

(3) Sentimental value (4) Potential value

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24. Main improvement of Indian Standard Soil Classification system over Unified Soil Classification system was

(1) division of fine-grained into four groups and inclusion of peat.

(2) division of fine-grained soil portion into six groups.

(3) division of fine-grained soil portion into six groups and inclusion of peat.

(4) division of fine-grained soil based on compressibility.

---

25. The maximum vertical stress occurs when the angle made by the polar ray attains a value corresponding to value of $\frac{r}{2}$ equal to

(1) 39° 13′ 53·5″ and 0·817 (2) 39° 13′ 53·5″ and 0·488

(3) 33° 33′ 33″ and 0·817 (4) 33° 33′ 33″ and 1·000

---

26. The shear strength of loamy soil depends upon

(1) internal friction

(2) cohesion

(3) both internal friction and cohesion

(4) neither internal friction nor cohesion

---

27. The mechanics of consolidation was demonstrated by Terzaghi by means of

(1) Newmark's influence chart (2) Spring analogy

(3) Isobar diagrams (4) Pressure bulb

---

28. Bearing capacity of soil is ***not*** influenced by

(1) shape and depth of footing (2) position of water table

(3) overcoming load on footing (4) type of soil

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29. Large movement of retaining structure is required to produce.

(1) active earth pressure

(2) passive earth pressure

(3) both active and passive earth pressures

(4) at rest pressure

---

30. When the allowable soil pressure is low or building loads are heavy, suitable type of foundation is

(1) Strap footing (2) Raft footing

(3) Spread footing (4) Combined footing

---

31. A normally consolidated clay stratum 5 m deep is underlain by hard rock. The average effective overburden pressure before and after construction was 25 KPa and 250 KPa. The laboratory tests on this strata indicated : natural moisture content of 50%, specific gravity of '3' and liquid limit of 54%. The consolidation settlement of this layer will be nearly equal to

(1) 0·4 m (2) 0·8 m

(3) 1·6 m (4) 2·0 m

---

32. The allowable load on a pile from pile load test is calculated as

(1) 50% load corresponding to a settlement of 10% pile diameter

(2) $\frac{2}{3}$ of load corresponding to a settlement of 12 mm

(3) 50% load corresponding to a settlement of 25 mm

(4) lesser of (1) and (2)

---

33. Pneumatic cassions are preferred in situations where the soil flow into the excavated area is _____ than it can be removed.

(1) slower (2) faster

(3) initially faster (4) initially slower

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34. Surface tension is a phenomenon due to

(1) cohesion only

(2) viscous force

(3) adhesion between liquid and solid molecules

(4) difference in magnitude between the forces due to adhesion and cohesion

---

35. An object weighs 100 N in air and 75 N in water when fully submerged in it. The specific gravity of the object is

(1) 4·0 (2) 4·5

(3) 2·5 (4) 1·25

---

36. A flow of fluid has diverging straight streamlines. If the flow is steady, the flow

(1) is a uniform flow with local acceleration

(2) has convective normal acceleration

(3) has convective tangential acceleration

(4) has convective normal as well as tangential accelerations

---

37. The head over a 90° V-notch increases from 0·20 m to 0·40 m. The ratio of the new discharge to the original discharge is

(1) 1·414 (2) 2·000

(3) 4·000 (4) more than 4·000

---

38. For a given open channel carrying a certain discharge, the critical depth depends on

(1) the geometry of the channel (2) the viscosity of the liquid

(3) the roughness of the channel (4) the longitudinal slope of the channel

---

39. In flow through pipe bends, the pressures on inner and outer radii

(1) do not vary and are same as at center of pipe

(2) vary, it being more on the inner one

(3) are different; pressure increases with increase in radius and is more on outer radius

(4) stand at same level, increasing towards centre

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40. The fluid flow in the model and the prototype will be dynamically similar if

(1) the forces in the two systems are same

(2) the two systems are geometrically similar

(3) the two systems are kinematically similar

(4) the forces at similar points in the two systems have same ratio throughout the flow field

---

41. The main function of the surge tank is to

(1) restrict the water hammer effects to small length of penstock

(2) provide a free water surface near turbines

(3) act as a reservoir

(4) protect the penstock from bursting

---

42. In all reaction turbines, the following conditions should be satisfied for maximum efficiency :

(1) The velocity of whirl at entrance must be zero

(2) The velocity of flow at outlet must zero

(3) Velocity of whirl at outlet must be zero

(4) Velocity of flow at entrance must be zero

---

43. In centrifugal pump, the inlet angle will be designed to have

(1) relative velocity vector in radial direction

(2) absolute velocity vector in radial direction

(3) velocity of flow to be zero

(4) peripheral velocity to be zero

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44. In a hydrological cycle, the average residence time of water in the global
(1) atmospheric moisture is larger than that in the global rivers
(2) oceans is smaller than that of the global groundwater
(3) rivers is larger than that of the global groundwater
(4) oceans is larger than that of the global groundwater

45. An isohyet is a line joining points having
(1) equal evaporation value
(2) equal barometric pressure
(3) equal height above the MSL
(4) equal rainfall depth in a given duration

46. Anticyclone is a
(1) low pressure zone that occurs in the northern hemisphere only
(2) high pressure zone with moderate winds
(3) zone of low pressure with clockwise winds in the northern hemisphere
(4) zone of low pressure with anticlockwise winds in the northern hemisphere

47. Hydrograph is a graph which shows the variation of discharge with
(1) rainfall (2) time
(3) runoff coefficient (4) rainfall excess

48. If the maximum depth of a 50 years – 15h rainfall depth at Bhubaneshwar is 260 mm, the 50 year-3h-maximum rainfall depth at the same place is
(1) < 260 mm (2) > 260 mm
(3) = 260 mm (4) None of the above

49. A catchment was found to have a ϕ-index of 0·6 cm/h in winter season. If a rainfall of 3 cm occurs in that season at a uniform rate in a 6 h storm, the resulting direct runoff is
(1) 0·6 cm (2) – 0·6 cm
(3) 0 cm (4) 6·6 cm

50. Indicate the ***incorrect*** statement out of following four statements in which PET stands for Potential Evapotranspiration :
(1) PET depends essentially on climatic factors and is not critically dependent on soil and plant factors.
(2) PET is same as the consumptive use of an irrigated crop.
(3) Decrease in PET of an area on the basis of mean annual value reflects an increase in runoff.
(4) The ratio of PET to lake evaporation is always greater than unity.

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51. The process by which plants dissipate water from the surface of their leaves, stalks and trunks in known as

(1) evaporation (2) evapo-transpiration

(3) delta (4) conjunctive use

52. Match the following lists :

	List I *(Plot of)*		*List II* *(Name)*
a.	Accumulated precipitation vs time in chronological order	I.	Hydrograph
b.	Rainfall intensity vs time	II.	Hyetograph
c.	Stream flow vs time in chronological order	III.	Flow-duration curve
d.	Steam discharge vs percent time the flow is equalled or exceeded	IV.	Mass curve of rainfall

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

53. If a soil has an infiltration capacity of f_c, actual infiltration rate f is given by

(1) $f < f_c$ when $i < f$ (2) $f = i$ when $i > f_c$

(3) $f = f_c$ when $i < f_c$ (4) $f < f_c$ when $i > f$

(where i = Rainfall intensity in above options)

54. The chemical that is found to be most suitable as water evaporation inhibitor is

(1) ethyl alcohol (2) methyl alcohol

(3) cetyl alcohol (4) butyl alcohol

55. A peak ordinate of a 4-h unit hydrograph for a catchment is 80 m^3/s. The peak ordinate of an 8-h unit hydrograph for the same catchment will be

(1) $> 80\ m^3/s$ (2) $= 80\ m^3/s$

(3) $< 80\ m^3/s$ (4) Data inadequate

SPACE FOR ROUGH WORK

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56. Conjunctive use of water in a basin means
(1) the sum of evapo-transpiration and the amount of water used up in plant metabolism.
(2) combined use of surface and ground water resources.
(3) combined use of water for irrigation and hydropower generation.
(4) the sum of evapo-transpiration and infiltration losses.

57. The moisture content of the soil after free drainage removes most of the gravity water is known as
(1) Wilting point (2) Available moisture
(3) Saturation capacity (4) Field capacity

58. If the duty on crop is reduced the irrigated area will be
(1) less (2) more
(3) does not depend on duty (4) None of the above

59. For the irrigation of a crop, the base period is 100 days and delta is 150 cm. Then the duty in ha/m^3. s on the field is
(1) 5·76 (2) 576 (3) 0·576 (4) 13·06

60. The ratio of the quantity of water stored in the root zone of the crop to the quantity of water actually delivered in the field is known as
(1) water conveyance efficiency (2) water application efficiency
(3) water use efficiency (4) water storage efficiency

61. Consumptive use for a particular crop is defined as
(1) water used by plant in transpiration only
(2) water used in evaporation from adjacent soils and plant leaves
(3) water used by plant in transpiration and evaporation also
(4) None of the above

62. Which of the statements given below are correct ?
In the check-basin method of irrigation
a. the ridges interfere with the movement of tractor drawn implements.
b. considerable land is wasted by ridges and lateral channels.
c. the surface drainage is unhindered and as such, is excellent.
d. is unsuitable for growing crops which are sensitive to wet-soil conditions around their stem.
(1) a, b and c (2) a, b and d (3) a, c and d (4) b, c and d

SPACE FOR ROUGH WORK

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63. The maximum application rate of sprinklers is limited by
(1) the infiltration capacity of the soil
(2) the prevailing wind velocity
(3) the quantity of water available
(4) the prevailing humidity and radiation

64. Leaching is the process in which
(1) water table is lowered by using pumps
(2) land is flooded with adequate depth of water to reduce salts in the top layer
(3) land is flooded with adequate depth of water to reduce salts in the bottom layer
(4) None of the above

65. An irrigant has the ionic concentrations of Na^{+}, Ca^{+2} and Mg^{+2} as 30, 10 and 8 meq/L respectively. The Sodium Adsorption Ratio (SAR) of this water is
(1) 0·10 (2) 3·33 (3) 10 (4) 1·66

66. A land is known as waterlogged when
(1) gravity drainage has ceased
(2) permanent wilting point is reached
(3) the soil becomes completely saturated
(4) capillary fringe reaches the root zone of the plants

67. An aqueduct means
(1) passing canal below the drainage
(2) passing canal below the road
(3) passing the drain through the canal
(4) passing the canal over the drainage

68. The uplift pressure is reduced _____ in a gravity dam when a drainage gallery with its drainage pipe system is provided.
(1) at all levels below the upstream level
(2) at all levels below the drainage gallery
(3) at all levels below the downstream level
(4) at the foundation level only

SPACE FOR ROUGH WORK

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69. In planning surveys for highways, which of the following studies is concerned with collection of details about the trend of population growth ?

(1) Engineering studies (2) Economic studies

(3) Financial studies (4) Traffic studies

---

70. Which of the following statements gives the most suitable meaning of highway alignment ?

(1) Fixing the direction of highway

(2) Deciding the radius of horizontal and vertical curves

(3) Determining the gradient of volley and summit curves

(4) Layout of the centre line of the highway on ground

---

71. Which of the following values is recommended by IRC as longitudinal friction coefficient for calculation of the stopping sight distance ?

(1) 0·05 to 0·10 (2) 0·15 to 0·20

(3) 0·25 to 0·30 (4) 0·35 to 0·40

---

72. Which of the following terms represents cross slope provided to the road surface to drain off the rainwater ?

(1) Shoulder (2) Camber

(3) Kerb (4) Drain

---

73. Width of the carriageway for single lane as standardised by IRC is

(1) 2·44 m (2) 2·50 m

(3) 3·50 m (4) 3·75 m

---

74. The mechanical widening of pavement required on horizontal curve along a two traffic lane road is given by which of the following equations ?

(1) $W_m = l^2/2R$ (2) $W_m = l^2/R$

(3) $W_m = 2l^2/R$ (4) $W_m = l^2/\sqrt{R}$

SPACE FOR ROUGH WORK

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75. It is not desirable to provide transition curve on which of the following types of curves ?

(1) Summit curves (2) Valley curves

(3) Sharp curves (4) Steep curves

76. In traffic engineering, which of the following information is collected by road side interview method ?

(1) Origin and destination data (2) Traffic capacity data

(3) Traffic volume data (4) Parking studies

77. CBR test is developed to evaluate which of the following ?

(1) Shearing resistance of soil (2) Modulus of subgrade reaction

(3) Stability of soil subgrade (4) Stress – strain relationship of soil

78. To study weathering action on road aggregate, which of the following tests is carried out ?

(1) Abrasion test (2) Crushing test

(3) Impact test (4) Soundness test

79. Guidelines of design of flexible pavement are recommended in which of the following IRC codes ?

(1) IRC 29 (2) IRC 37

(3) IRC 58 (4) IRC 86

80. As per IRC recommendations for design of concrete pavements, the flexural strength of cement concrete used in the pavement should ***not*** be less than

(1) 6 kg/cm^2 (2) 24 kg/cm^2

(3) 30 kg/cm^2 (4) 40 kg/cm^2

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81. A small bridged passage for the conveyance of water, under the road, from one side of the roadway to the other side is known as
(1) Underground drain (2) Channel
(3) Aqueduct (4) Culvert

82. If afflux is more, scour depth
(1) will be less (2) will be more
(3) will have no effect on it (4) None of the above

83. IRC recommendations for minimum width of footpath on bridge is
(1) 1·0 m (2) 1·5 m (3) 2·0 m (4) 2·5 m

84. IRC standard loading for bridge designs are
(1) Class A, Class B, Class AB and Class 70-R
(2) Class A, Class B, Class AB and Class 90-R
(3) Class A, Class B, Class BB and Class 70-R
(4) Class A, Class B, Class AA and Class 70-R

85. The type of bearing used on a bridge, depends on
(1) Amount of movement of the bridge ends
(2) Temperature variations
(3) Load carried
(4) All of the above

86. Abutment piers are provided in multiple span
(1) Arch bridges (2) Submersible bridges
(3) Temporary bridges (4) Suspension bridges

87. The difference between the designed H.F.L. allowing for afflux, if any, and the level of crown of road at its lower point, whether on the bridges or its approaches, is known as
(1) Head room (2) Free room
(3) Highest water level (4) Free board

88. Culverts are provided for linear waterway upto maximum of
(1) 6 m (2) 9 m (3) 12 m (4) 15 m

89. A thin wall used as a shield or protection against scouring action of stem is called
(1) Baffle wall (2) Dwarf wall
(3) Curtain wall (4) Any of the above

90. Floats are used to measure
(1) Discharge of stream (2) Velocity of stream
(3) Flood discharge (4) Afflux

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91. Which air pollutant is ***not*** included in National Ambient Air Quality Standards 2009 ?

(1) Ozone (2) Benzene

(3) Mercury (4) Arsenic

---

92. The fire demand for a population of 1·5 lakh as per the recommendation of IS 9668 : 1990 is

(1) 1800 litre/min (2) 3600 litre/min

(3) 5400 litre/min (4) 7200 litre/min

---

93. The following characteristics pertain to the sand filters in water treatment :

a. The effective size of filter medium is 0·25 mm to 0·35 mm.

b. Backwashing is carried out by air scouring followed by water washing.

c. The suspended solids are removed at the surface on biofilm mat.

Which of these are related to slow sand filters ?

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

(3) a and c (4) b and c

---

94. What are the Ambient Air Quality Standards in respect of noise in daytime for industrial and commercial areas respectively ?

(1) 75, 65 dB(A) Leq. (2) 75, 70 dB(A) Leq.

(3) 75, 55 dB(A) Leq. (4) 65, 55 dB(A) Leq.

---

95. The following data pertain to a sewage sample at 20°C :

Initial dissolved oxygen = 6 mg/L

Final dissolved oxygen after 5 days = 3·5 mg/L

Dilution ratio = 0·02

The BOD_5 of the above sample at 20°C is

(1) 500 mg/L (2) 125 mg/L

(3) 175 mg/L (4) 12·5 mg/L

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96. Which of the following is attached growth process used for waste water treatment ?

(1) Rotating Biological Contactor (2) Activated Sludge Process

(3) Aerated Lagoon (4) Waste Stabilization Pond

---

97. Which of the following pairs is/are correctly matched ?

a. Trickling filter – Attached growth anaerobic treatment system

b. Activated sludge process – Suspended growth aerobic treatment system

c. Oxidation pond – Suspended growth aerobic treatment system

d. Oxidation ditch – Modified activated sludge process

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

(3) b and d (4) a, b, c and d

---

98. Factors that influence sedimentation process are

(1) size, viscosity, density and temperature of water

(2) surface overflow rate, detention time

(3) inlet and outlet characteristics, depth of settling

(4) All the above

---

99. Which of the following statements are correct ?

a. The burning of gasoline fuel emits carbon monoxide.

b. Sulphur dioxide is formed from coal burning.

c. The burning of tyres results in hydrocarbons.

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

(3) b and c (4) a, b and c

---

100. What is the standard for *E. coli* as per Drinking Water Quality Standards IS : 10500 ?

(1) 10/100 mL (2) 5/100 mL

(3) 0/100 mL or absent (4) 1/100 mL

SPACE FOR ROUGH WORK

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परीक्षेचे नांव : महाराष्ट्र अभियांत्रिकी सेवा (स्थापत्य), गट- ब (मुख्य)- परीक्षा -२०१२ परीक्षेचा दिनांक: १५ व १६ डिसेंबर,२०१२
विषय : (प्रश्नपत्रिका क्र. ३) स्थापत्य अभियांत्रिकी - पेपर क्र.२

महाराष्ट्र अभियांत्रिकी सेवा (स्थापत्य), गट- ब (मुख्य) परीक्षा - २०१२ या स्पर्धा परीक्षेच्या प्रश्नपत्रिकेची उत्तरतालिका उमेदवारांच्या माहितीसाठी संकेतस्थळावर प्रसिध्द करण्यात आली होती. त्यासंदर्भात उमेदवारांनी अधिप्रमाणित (Authentic) स्पष्टीकरण / संदर्भ देऊन पाठविलेली लेखी निवेदने, तसेच तज्ज्ञांचे अभिप्राय विचारात घेऊन आयोगाने उत्तरतालिका सुधारित केली आहे. या उत्तरतालिकेतील उत्तरे अंतिम समजण्यात येतील. यासंदर्भात आलेली निवेदने विचारात घेतली जाणार नाहीत व त्याबाबत कोणताही पत्रव्यवहार केला जाणार नाही, याची कृपया नोंद घ्यावी.

उत्तरतालिका

प्रश्न क्रमांक	उत्तरे			
	संच A	संच B	संच C	संच D
1	4	3	2	3
2	3	2	1	3
3	2	3	3	4
4	1	2	3	3
5	3	4	4	2
6	3	2	3	1
7	3	3	3	2
8	2	4	2	3
9	3	3	4	3
10	2	2	2	2
11	4	1	3	3
12	2	3	3	2
13	3	3	2	4
14	1	3	4	3
15	4	4	2	3
16	1	1	1	3
17	4	3	4	4
18	2	3	1	1
19	3	1	3	4
20	4	4	3	2
21	1	1	3	1
22	3	4	4	4
23	3	2	1	1
24	3	2	2	3
25	1	2	4	2

प्रश्न क्रमांक	उत्तरे			
	संच A	संच B	संच C	संच D
26	3	2	2	3
27	2	4	2	3
28	3	2	2	1
29	2	3	3	4
30	2	1	2	2
31	2	3	3	2
32	4	2	3	2
33	2	3	1	2
34	4	4	3	1
35	1	1	2	3
36	3	3	4	4
37	4	2	1	1
38	1	4	1	3
39	3	1	3	4
40	4	3	4	2
41	1	4	1	4
42	3	1	3	1
43	2	3	4	3
44	4	2	3	3
45	4	1	3	4
46	2	1	2	4
47	2	3	1	4
48	1	3	1	2
49	3	4	3	2
50	4	4	4	1

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प्रश्न क्रमांक	उत्तरे			
	संच A	संच B	संच C	संच D
51	2	2	4	3
52	1	2	4	2
53	1	1	2	1
54	3	3	2	1
55	3	4	1	3
56	2	1	3	4
57	4	2	2	4
58	1	3	2	1
59	2	4	4	1
60	2	4	1	2
61	3	1	2	3
62	2	2	2	4
63	1	4	4	1
64	2	1	1	2
65	3	2	1	2
66	4	2	2	3
67	4	3	3	2
68	1	2	4	2
69	2	1	2	4
70	4	1	4	2
71	4	3	1	2
72	2	4	1	4
73	4	2	3	4
74	2	4	4	2
75	1	2	2	2

प्रश्न क्रमांक	उत्तरे			
	संच A	संच B	संच C	संच D
76	1	4	4	4
77	3	4	2	1
78	4	2	2	1
79	2	4	4	3
80	4	2	4	4
81	4	2	4	3
82	2	2	4	4
83	2	4	1	2
84	4	4	4	4
85	4	1	3	2
86	1	4	4	2
87	4	3	2	4
88	3	4	4	4
89	4	2	2	1
90	2	4	2	4
91	3	1	1	1
92	3	3	2	3
93	3	4	3	1
94	1	1	3	3
95	2	3	3	4
96	1	3	1	1
97	3	3	3	2
98	4	3	1	3
99	1	1	3	3
100	3	2	4	3

date - 18th January, 2013

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CODE : JO2

A

2013

प्रश्नपुस्तिका क्रमांक
BOOKLET NO.

प्रश्नपुस्तिका
स्थापत्य अभियांत्रिकी
पेपर-I

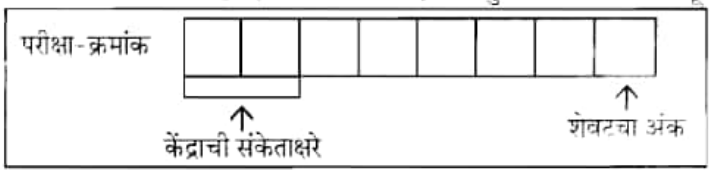
वेळ : 2 (दोन) तास

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. असा 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.

(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

SEAL

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1. Consider the following statements :

(a) The melting point of mild steel is 1400°C

(b) The ultimate compressive strength of mild steel is 80 to 120 KN/cm^2

Now state whether :

(1) (a) True, (b) False (2) (a) False, (b) False

(3) (a) True, (b) True (4) (a) False, (b) True

---

2. The bearing capacity of soil can be determined by :

(1) method of loading (2) plate load test

(3) both (1) and (2) (4) none of the above

---

3. For what span is the Queen Post roof truss suitable ?

(1) 5 to 9 m (2) 9 to 14 m

(3) 14 to 18 m (4) none of the aobve

---

4. What is a Header as seen in elevation of wall ?

(1) Longer face of brick

(2) Horizontal distance between vertical joints of successive brick courses

(3) Lower surface of brick when laid flat

(4) Shorter face of brick

---

5. What is the temperature range in the low temperature tempering process ?

(1) 150°C to 200°C (2) 200°C to 250°C

(3) 100°C to 150°C (4) 250°C to 300°C

---

6. In site exploration, method of open trial pits is adopted upto a depth of :

(1) 3 m (2) 6 m (3) 10 m (4) 15 m

SPACE FOR ROUGH WORK

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7. A distemper is composed of a base with :

(1) Chalk (2) Water (3) Casein (4) Glue

8. What causes Bulking of sand ?

(1) Surface moisture (2) Clay content

(3) Air voids (4) Viscosity

9. For what span is the king post roof truss suitable :

(1) 5 to 9 m (2) 9 to 14 m

(3) 14 to 18 m (4) none of the above

10. The reflected sound concentrated at one point creates a spot which is known as :

(1) Dead spot (2) Sound foci (3) Sound echo (4) Accostics

11. The common criterion for size of doors used in India is :

(1) Width = {0.40 to 0.60} height (2) Height = {width + 1.2 meter}

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

12. What is the recommended slump value for rigid pavement construction ?

(1) 40 to 50 mm (2) 10 to 25 mm (3) 25 to 50 mm (4) 20 to 40 mm

13. What is strengthening the shallow foundations of an existing building called ?

(1) Scaffolding (2) Staging (3) Underpinning (4) Bracing

14. What is the average thickness of first coat of cement mortar plaster on brick masonry ?

(1) 10 mm (2) 8 mm (3) 20 mm (4) 12 mm

SPACE FOR ROUGH WORK

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15. What is the Diamond bit used as cutting tool in core drilling called ?

(1) Shot (2) Bort (3) Port (4) Bortz

16. How is the Zone between parallels of lattitude 23° 27'N and 23° 27'S known as ?

(1) Torrid Zone (2) North Temperate Zone

(3) South Temperate Zone (4) North Frigid Zone

17. In a flitched beam, one section is reinforced with another section. The purpose of such a composite beam is to improve _____.

(1) Shear force over the section (2) Moment of Resistance over the section

(3) Appearance of the seciton (4) All of these

18. A column of length 'L' is fixed at bottom and hinged at top then the equivalent length of column is taken as :

(1) L (2) 2L (3) L/2 (4) $L/\sqrt{2}$

19. A circular rod of length 1m is fixed at the top and a collar is provided at the bottom. An instantaneous stress developed in the rod due to releasing load is 400 MPa. If the diameter of rod is 10 mm. Find the strain energy stored in the rod. (E=200 GPa).

(1) 5π (2) 10π (3) 12π (4) 15π

20. If a cantilever beam is subjected to a point load at its free end, then the shear force under the point load is :

(1) zero (2) less than the load

(3) equal to the load (4) more than the load

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21. The bulk modulus of an elastic body subjected to normal tensile stresses in all directions (x, y and z) is _____.

Where μ - poisson's ratio and E - young's modulus.

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

---

22. Two bars of the same size but of different materials are subjected to the same tensile force. If the bars have their axial elongation in the ratio of 2 : 3, the ratio of modulus of elasticity of the two materials will be :

(1) 2 : 3 (2) 3 : 2 (3) 6 : 4 (4) 4 : 10

---

23. If a metal bar fixed at either ends is cooled by reducing the temperature by 30°C, the nature of the stresses developed in the bar will be :

(1) Tensile (2) Compressive

(3) Zero (4) None of the above

---

24. A beam of span 'L' is simply supported at ends A and B carries a point load at C at a distance 'a' from A and 'b' from B. If a < b then the maximum deflection will occur :

(1) at C (2) Between A and C

(3) Between B and C (4) Any where along the span

---

25. A circular bar of length (l) uniformly tapers from diameter (d_1) at one end to diameter (d_2) at the other end. If the bar is subjected to axial tensile force (p) then its elongation is equal to _____ ($d_1 > d_2$)

(1) $\frac{PL}{AE}$ (2) $\frac{PL}{A_1A_2E}$ (3) $\frac{4PL}{\pi E d_1 d_2}$ (4) $\frac{PL}{4\pi E d_1 d_2}$

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26. When a body is subjected to the mutually perpendicular stresses (σx and σy) then the centre of the mohr's circle from y-axis is taken as :

(1) $\frac{\sigma x + \sigma y}{2}$ (2) $\frac{\sigma x - \sigma y}{2}$

(3) $\frac{\sigma x - \sigma y}{2} + \tau XY$ (4) $\frac{\sigma x - \sigma y}{2} - \tau XY$

---

27. What does moment area method find ?

(1) Bending moment of beam (2) Deflection of beam

(3) Moment of Inertia (4) Reactions of beam

---

28. If a body is subjected to a direct normal stress of intensity 'δ' along 'X' direction, then the intensity of maximum shear stress developed on the plane inclined at 45° to line of action of applied stress will be _____.

(1) δ (2) $\frac{\delta}{2}$ (3) 2δ (4) 0

---

29. If a circular shaft of diameter (D) is fixed at one end and subjected to torsional moment (T) at other end, then shear stress developed in shaft is :

(1) $16T/\pi D^3$ (2) $\pi T/16D^3$ (3) $32T/\pi D^4$ (4) $16T/\pi D^4$

---

30. Elongation of a circular rod tapering from zero at one end and diameter 'D' at the other end with 'γ' as the density and 'L' as the Length due to self weight is _____.

(1) $\frac{\gamma L^2}{2E}$ (2) $\frac{L^2}{2\gamma E}$ (3) $\frac{\sigma L}{\gamma E}$ (4) $\frac{\gamma L^2}{\sigma E}$

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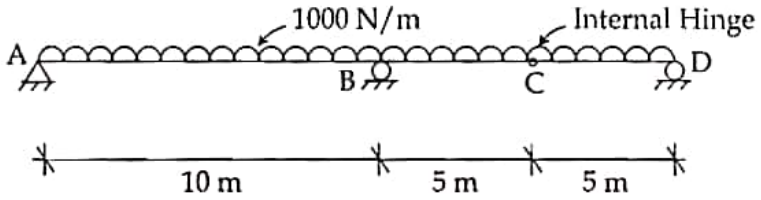
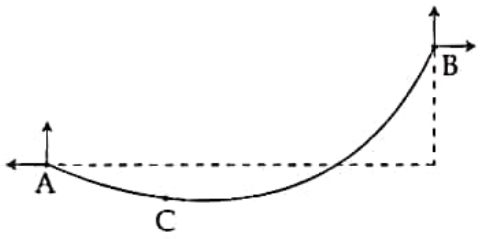
31. The reaction for the support 'B' of a beam loaded as shown in fig. is :



(1) 5000 N (2) 10000 N (3) 1250 N (4) 15000 N

---

32. In the cable shown in fig the minimum tension occurs at :



(1) A (2) B

(3) C (4) Between (A) and (C)

---

33. A beam AB of Length 'L' is hinged at its ends and carries a transverse external loading such that the end 'B' is sunk by an amount 'δ'. The fundamental slope deflection equation is :

(1) $M_{AB} = \frac{2EI}{L}\left(\theta_A + 2\theta_B - \frac{3\delta}{L}\right) + M_{FAB}$

(2) $M_{AB} = \frac{3EI}{L}\left(2\theta_A + \theta_B - \frac{3\delta}{L}\right) - M_{FAB}$

(3) $M_{AB} = \frac{3EI}{L}\left(2\theta_A + \theta_B + \frac{3\delta}{L}\right) - M_{FAB}$

(4) $M_{AB} = \frac{2EI}{L}\left(2\theta_A + \theta_B - \frac{3\delta}{L}\right) + M_{FAB}$

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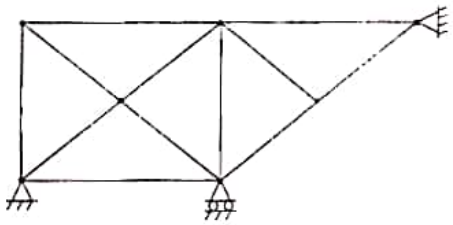
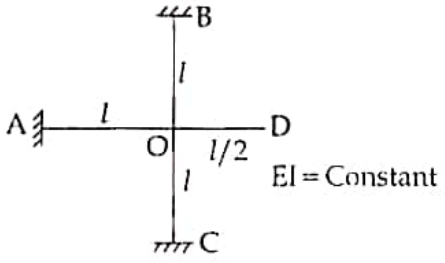
34. The degree of static indeterminancy in the frame shown in fig. is :



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

---

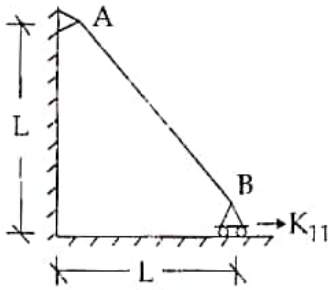
35. A steel frame is shown in the figure. If joint 'O' of the frame is rigid, the rotational stiffness of the frame at point 'O' is given by :



(1) $11EI/l$ (2) $10EI/l$ (3) $8EI/l$ (4) $6EI/l$

---

36. Horizontal stiffness coefficient K_{11} of bar 'AB' is given by :



(1) $AE/l\sqrt{2}$ (2) $AE/2l$ (3) AE/l (4) $2AE/l$

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37. For a three hinged parabolic arch (span 'l', rise h) carrying a uniformly distributed load w/unit length covering the entire span pick up the correct statement from the following :

(1) horizontal thrust is $wl^2/8h$ (2) S.F. will be zero throughout

(3) B.M will be zero throughout (4) all the above

---

38. In moment distribution method of analysis, the following statement is true :

(1) The absolute stiffness of a prismatic bar with far end being fixed is 4EI/L

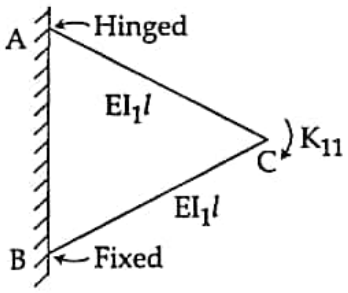
(2) The absolute stiffness of a prismatic bar with far end being simply supported is 3EI/4L

(3) The absolute stiffness of a prismatic bar with far end being pin-jointed is 3EI/L

(4) All the above

---

39. Rotational stiffness coefficient K_{11} for the frame having two members of equal EI/l is given by :



(1) 5EI/l (2) 6EI/l (3) 7EI/l (4) 8EI/l

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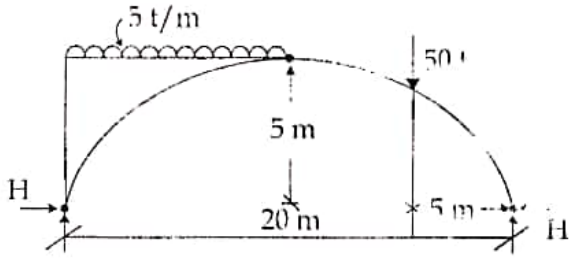
40. A three hinged arch of span 20 m and rise 5 m is loaded as shown in fig. The horizontal thrust 'H' is :



(1) 75 t (2) 100 t (3) 125 t (4) 50 t

---

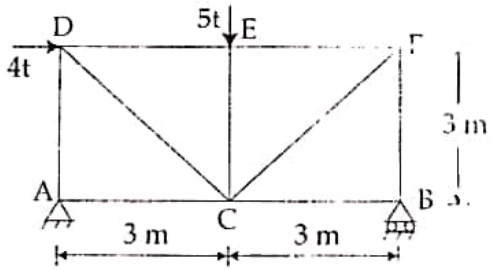
41. For which structures Influence lines are drawn ?

(1) of any type (2) statically determinate

(3) pin - jointed stress (4) none of the above

---

42. The force in member AC of the truss shown in fig. is :



(1) 5t tension (2) 4t compression

(3) 4t tension (4) 5t compression

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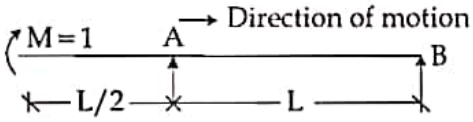
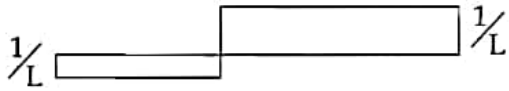
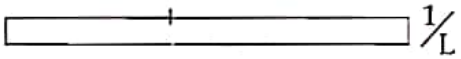
43. A simply supported beam with an overhang is traversed by a unit concentrated moment from left to the right as shown below :



The influence line for reaction at 'B' is given by

(1)

(2) 

(3) 

(4) Zero everywhere

---

44. A two hinged parabolic arch of span 'l' and rise 'h' carries a load varying from zero at the left end and 'w' per unit run at the right end. The horizontal thrust is :

(1) $wl^2/4h$ (2) $wl^2/8h$ (3) $wl^2/12h$ (4) $wl^2/16h$

---

45. A cross section which can develop plastic moment of resistance but have inadequate plastic hinge rotation capacity for formation of plastic mechanism is called as :

(1) class 1 - plastic section (2) class 2 - compact section

(3) class 3 - semi compact section (4) class 4 - slender section

---

46. In plate girder, the web plate is connected to the flange plates by fillet weld. The size of fillet weld is designed to resist :

(1) The vertical shear force at the section

(2) The force causing buckling in the web

(3) The horizontal shear force between flange and web plate

(4) The bending stress in the flange

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47. As per IS 800-2007, Tensile strength of a tension member is :

(1) Strength corresponding to yielding of gross area

(2) Strength corresponding to rupture at critical/net section

(3) Strength corresponding to block shear failure

(4) Minimum of all of the above

---

48. As per IS 800-2007 design strength of a fillet weld is given by $f_{wd} = \frac{f_u}{\sqrt{3}\ \gamma_{mw}}$, where :

(1) fu is ultimate strength of weld and γ_{mw} is partial safety factor of weld

(2) fu is ultimate strength of parent material and γ_{mw} is partial safety factor of weld

(3) fu is smaller of ultimate strength of weld or parent material and γ_{mw} is smaller of partial safety factor of weld or parent material

(4) fu is smaller of ultimate strength of weld or parent material and γ_{mw} is partial safety factor of weld

---

49. On what basis is the thickness of base plate in a column base decided ?

(1) Flexure in base plate (2) Axial compression in base plate

(3) Axial tension in base plate (4) Shear in base plate

---

50. As per IS 875-1984, If $V_z = K_1 . K_2 . K_3 . V_b$ represents design wind velocity then K_3 is _____.

(1) Risk co-effecient (2) Terrain, height and size co-effecient

(3) Topography coefficient (4) None of the above

---

51. What is the intensity of imposed load on the plan area of a roof truss with 20° slope ? Consider that access is not provided except for maintenance :

(1) 0.55 kN/m^2 (2) 0.75 kN/m^2

(3) 0.45 kN/m^2 (4) 0.4 kN/m^2

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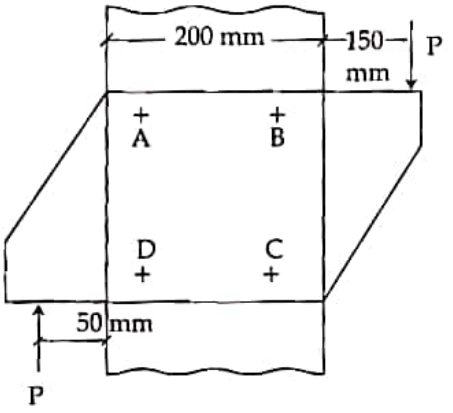
52. A secondary beam ISMB 500 transmits end reaction to the web of main beam ISMB 500. Which of the following types of connection is advisable ?

(1) Frame connection (2) Unstiffened seat connection

(3) Stiffened seat connection (4) Bracket connection

---

53. Maximum resultant shear force acting in a critical rivet/bolt for the following arrangement is :



AB = 120 mm

and BC = 160 mm

(1) 4P (2) p (3) 2p (4) p/4

---

54. Match **Group - I** with **Group - II**

	Group - I		**Group - II**
(a)	IS 800 - 2007	(i)	General constructions in steel - code of practice
(b)	IS 1893 - 2002	(ii)	Code of practice for design loads (other than earthquake) for building structures
(c)	IS 875 - 1987	(iii)	Criteria for earthquake resistance design of structure
(d)	IS 456 - 2000	(iv)	Plain and reinforced concrete - code of practice

Answer options :

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

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55. A column section is built using two channels keeping back to back at such a spacing that it is equally strong with reference to both the axes. One Engineer suggests lacing while other suggests battens to connect two channels together. Keeping all other parameters same, which of the following is true :

(1) Laced column will carry more load than battened column

(2) Battened column will carry more load than laced column

(3) Capacity of a column is independent of lacing or batten

(4) None of above statements is true

---

56. What is the maximum permissible bearing pressure on concrete below the base plate in a column ?

(1) $0.7\sqrt{fck}$ (2) 0.446 fck (3) 0.67 fck (4) 0.6 fck

---

57. Which of the following is not a solution to limit the web crippling stresses within their permissible value ?

(1) Increasing bearing length (2) Selecting a beam with thicker web

(3) Providing a bearing stiffener (4) Selecting a beam with wide flange

---

58. As per IS800-2007, the minimum diameter of rivet/bolt for joining compression members composed of two components back to back of thickness 10 mm, upto and including 16 mm is :

(1) 16 mm (2) 22 mm (3) 12 mm (4) 20 mm

---

59. For comfortable ascend on stairs, the number of steps in each flight should not be greater than :

(1) 09 (2) 12 (3) 10 (4) 11

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60. A RC column 45 cm × 45cm in section and reinforced with longitudinal reinforcement having 20 sq. cm sectional area is 5 m high. It is fixed at the bottom and perfectly free at top. If the max. allowable stresses are 42.2 kg/ cm^2 and 948 kg/ cm^2 in concrete and steel determine max. load carrying capacity :

(1) 48.5 tonnes (2) 58.5 tonnes (3) 65.5 tonnes (4) 85.3 tonnes

---

61. In simply supported slab the purpose of providing distribution reinforcement is :

(1) To distribute the loads (2) To distribute the shrinkage stress

(3) To distribute the temp stresses (4) All of the above

---

62. A T-beam of a roof is 76 cm deep upto centre of tensile steel and has a 152 cm wide flange which is 10 cm thick the width of web is 30 cm. In order to resist a moment of 4.5×10^6 kg cm safely, the minimum area of steel required would be approximately :

(1) 10 sq.cm (2) 25 sq.cm (3) 50 sq.cm (4) 100 sq.cm

---

63. For dog legged stair case floor to floor height is 3.2 m, Rise : 160 mm, tread : 250 mm Depth of waist slab : 200 mm, L.L. =3 kN/m^2 F.F. 1 kN/m^2 total working load on stair case is about :

(1) 18 kN/m^2 (2) 12 kN/m^2 (3) 16 kN/m^2 (4) 20 kN/m^2

---

64. For counterfort Retaining wall, If l is clear distance between the counterfort and P is the intensity of soil pressure. The slab is designed for Bending Moments :

(1) Maximum +ve Bm and −ve Bm is $\frac{PL^2}{16}$ and $\frac{PL^2}{12}$

(2) Maximum +ve Bm and −ve Bm $\frac{PL^2}{24}$ and $\frac{PL^2}{12}$

(3) Maximum +ve Bm and −ve Bm $\frac{PL^2}{16}$ and $\frac{PL^2}{8}$

(4) Maximum +ve Bm and −ve Bm $\frac{PL^2}{24}$ and $\frac{PL^2}{8}$

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65. In water retaining structures upto 100 mm thickness the minimum reinforcement in walls floors and roofs in each of the two directions at right angle shall have minimum area equal to :

(1) 0.03% of the concrete section (2) 0.3% of the concrete section

(3) 0.2% of the concrete section (4) 0.12% of the concrete section

---

66. In a retaining wall, keyed expansion and contraction joints should be provided at an interval of :

(1) 15 m (2) 20 m (3) 30 m (4) 45 m

---

67. An overhead water tank of capacity 40,000 litres is considered as a :

(1) small tank (2) medium tank

(3) large tank (4) very large tank

---

68. While designing the isolated square column, if p' is the net upward reaction, a is the length of one side of the square footing of column of side b and d is the effective depth of footing, then the punching shear is given by :

(1) $p'(a^2+b^2)/4ad$ (2) $p'(a^2-b^2)/4bd^2$

(3) $p'(a^2-b^2)/4bd$ (4) $p'(a-b)^2/4bd$

---

69. A rectangular beam simply supported over a span of 6 m is provided with tensile reinforcement only. The beam 200 mm wide and 365 mm deep (effective) consists of 4 no. 16 ϕ, the beam carries a load of 8 kN/m inclusive of self weight and m=13. The maximum Bending moment :

(1) 36×10^8N mm (2) 36×10^7N mm

(3) 36×10^6N mm (4) 36×10^4N mm

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70. A RC beam 25 cm × 50 cm in section has a clear span of 5 m and carries a load of 3000 kg/m it is reinforced with 8 bars of 12 mm dia at the bottom and depth of N.A. below the top is 23 cm. The per bend stress is 10 kg/ cm^2. The number of bars that should be bent to take the diagonal tension would be :

(1) 02 (2) 03 (3) 04 (4) 05

---

71. In case of RC footing on soils it is usual to keep a minimum overall depth at the edges equal to :

(1) 5 cm (2) 10 cm (3) 15 cm (4) 25 cm

---

72. Critical section for shear in case of flat slab is at a distance of :

(1) effective depth of slab from periphery of column or drop panel

(2) d/2 from periphery of column or capital

(3) at the drop panel of slab

(4) at the preiphery of column

---

73. The approximate loss of prestress due to the slippage of anchorage in long span prestressed concrete is generally in the range of :

(1) 1 to 3 percent (2) 3 to 5 percent

(3) 5 to 8 percent (4) 8 to 12 percent

---

74. A pretensioned T-section has a flange of 1200 mm wide and 150 mm thick width of rib 300 mm and depth 1600 mm, fpu = 1392 N/mm^2 Apw = 3182 mm^2, xu = 896mm, fck = 40N/mm^2. Flexural strength of the T-section is about :

(1) 9125 kN m (2) 8000 kN m (3) 7000 kN m (4) 8250 kN m

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75. What is the purpose of reinforcement in prestressed concrete ?

(1) to provide adequate bond stress

(2) to resist tensile stresses

(3) to impart initial compressive stress in concrete

(4) all of the above

---

76. Most common method of prestressing used for factory production is :

(1) Long Line Method (2) Freyssinet system

(3) Magnel Blaton system (4) Lee - Macall system

---

77. For small span girders with straight tendons approximate thickness of web is. If $vu = 28 \times 10^3$N, $ft = 1.7 N/mm^2$ depth of girder $= 320$ mm

(1) 44 mm (2) 60 mm (3) 75 mm (4) 30 mm

---

78. A pretensioned prestressed concrete beam having rectangular section 150 mm × 350 mm deep has an effective cover of 50 mm $fck = 40 N/mm^2$ $fpu = 1253\ N/mm^2$, $Ap = 461\ mm^2$, xu=234.9 ultimate strength of the section using IS code is :

(1) 116 kN m (2) 140 kN m (3) 200 kN m (4) 190 kN m

---

79. For post tensioned member the minimum 28 day cube strength as per IS code is :

(1) $20\ N/mm^2$ (2) $30\ N/mm^2$ (3) $40\ N/mm^2$ (4) $50\ N/mm^2$

---

80. An eccentric tendon anchored perpendicular to the plane of concrete at the end section in prestressed beams introduces :

(1) compression (2) bending and compression

(3) compression, bending and shear (4) tension and shear

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81. According to IS 1343-1980, the bearing stress shall not exceed :

(1) 0.48 fci × $\sqrt{Abr/A\ punch}$ or 0.8 fci

(2) 0.6 fci × $\sqrt{Abr/A\ punch}$ or 0.85 fci

(3) 0.7 fci × $\sqrt{Abr/A\ punch}$ or 0.8 fci

(4) 0.48 fci × $\sqrt{Abr/A\ punch}$ or 0.9 fci

---

82. In case of prestressed concrete beams (girder) the lever arm is :

(1) Always constant

(2) Negligibly small

(3) Subject to change as the load on the girder changes

(4) does not exist in the absence of live load

---

83. In High - tensile steel final stress after allowing for all losses of prestress (As per IS 1343 - 1980) :

(1) Not less than 50% of the characteristic tensile strength of tendons

(2) Not less than 20% of the characteristic tensile strength of tendons

(3) Not less than 45% of the characteristic tensile strength of tendons

(4) Not less than 30% of the characteristic tensile strength of tendons

---

84. The approximate total percentage loss of prestressed in post - tensioned concrete beam is nearly in the range :

(1) 5 to 10 percent (2) 10 to 15 percent

(3) 15 to 20 percent (4) 20 to 25 percent

---

85. For long span girders with curved cables approximate thickness of web for the following data (Vu = 450 kN, ft = 1.7 N/mm^2, depth of girder 1300 mm) is :

(1) 170 mm (2) 200 mm (3) 120 mm (4) 300 mm

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86. The bursting stresses in prestressed concrete members are developed at :

(1) Bond zone (2) Maximum shear zone

(3) Anchorage zone (4) Maximum bending moment zone

---

87. What are the main resources required for construction industry ?

(1) manpower and material (2) manpower and machinery

(3) machinery and material (4) all the above

---

88. Which of the following control charts is suitable to control the defects per unit ?

(1) $\overline{X}$ and R chart (2) P chart (3) np chart (4) C chart

---

89. What does the direct cost of project include ?

(1) labour cost (2) material cost (3) equipment cost (4) all the above

---

90. Consider the following statements :

(a) Critical path is longest path in network

(b) Critical path is obtained by joining the event having zero or minimum slack. Now state whether

Answer options :

(1) (a) True, (b) True (2) (a) False, (b) False

(3) (a) True, (b) False (4) (a) False, (b) True

---

91. Which of the following is shown on site layout for allocation of site space ?

(1) material storage (2) working areas

(3) circulation areas (4) all the above

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92. Consider the following statements :

(a) PERT is activity oriented network diagram

(b) CPM is event oriented network diagram

Now state whether :

Answer options :

(1) (a) true, (b) true (2) (a) true, (b) false

(3) (a) false, (b) false (4) (a) false, (b) true

---

93. What are the objectives of construction management :

(1) High Quality Workmanship (2) Motivating people

(3) Taking sound decisions (4) all of the above

---

94. Which of the following terms represents the settlement of disputes by unoffical persons chosen by the parties ?

(1) Force Mojure (2) Arbitration (3) Indemnification (4) contract

---

95. What is the formula for free float ?

(1) $F.F. = T_L^j - T_E^i - t_{ij}$ (2) $F.F. = T_E^j - T_E^i - t_{ij}$

(3) $F.F. = T_E^j - T_L^i - t_{ij}$ (4) $F.F. = T_L^j - T_L^i - t_{ij}$

---

96. What type of a drill is the Jack hammer ?

(1) Abrasion (2) Churn (3) Shot (4) Percussion

SPACE FOR ROUGH WORK

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97. Consider the following statements :

(a) Upto certain duration direct cost decreases, and there - after it starts increasing

(b) Total cost of the project is a sum of direct costs and indirect costs.

Now state whether :

(1) (a) true, (b) true (2) (a) true, (b) false

(3) (a) false, (b) false (4) (a) false, (b) true

---

98. The purpose of job layout is to facilitate the realisation of :

(1) reduction in completion time

(2) high productivity from labour and machinery

(3) both (1) and (2)

(4) none of the above

---

99. Well points operate satisfactorily if they are installed in :

(1) silt (2) clay (3) sand (4) rock

---

100. Which of the following effects is produced due to compaction by pneumatic tired rollers ?

(1) Static weight (2) Impact

(3) Kneading action (4) Vibration

- o 0 o -

SPACE FOR ROUGH WORK

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परीक्षेचे नांव : महाराष्ट्र अभियांत्रिकी (स्थापत्य) सेवा, गट - ब (मुख्य) परीक्षा - 2013

परीक्षेचा दिनांक : 31 ऑगस्ट व १ सप्टेंबर 2013 विषय : (प्रश्नपत्रिका क्र. २) स्थापत्य अभियांत्रिकी - पेपर - I

महाराष्ट्र अभियांत्रिकी सेवा (स्थापत्य), गट- ब (मुख्य) परीक्षा - २०१३ या स्पर्धा परीक्षेच्या प्रश्नपत्रिकेची उत्तरतालिका उमेदवारांच्या माहितीसाठी संकेतस्थळावर प्रसिध्द करण्यात आली होती. त्यासंदर्भात उमेदवारांनी अधिप्रमाणित (Authentic) स्पष्टीकरण / संदर्भ देऊन पाठविलेली लेखी निवेदने, तसेच तज्ज्ञांचे अभिप्राय विचारात घेऊन आयोगाने उत्तरतालिका सुधारित केली आहे. या उत्तरतालिकेतील उत्तरे अंतिम समजण्यात येतील. यासंदर्भात आलेली निवेदने विचारात घेतली जाणार नाहीत व त्याबाबत कोणताही पत्रव्यवहार केला जाणार नाही, याची कृपया नोंद घ्यावी.

उत्तरतालिका - KEY

पेपर - I

प्रश्न क्रमांक	उत्तरे			
	संच A	संच B	संच C	संच D
1	3	3	4	1
2	3	1	1	#
3	2	1	1	3
4	4	3	1	3
5	1	3	3	4
6	1	2	2	1
7	#	1	3	3
8	1	4	2	1
9	1	4	3	4
10	2	3	1	2
11	3	2	3	1
12	4	4	4	1
13	3	1	4	4
14	4	#	1	2
15	4	1	4	4
16	1	4	#	3
17	2	3	2	2
18	4	3	3	3
19	2	3	1	1
20	3	2	2	#
21	3	1	3	4
22	1	#	3	2
23	1	1	2	1
24	3	2	4	3
25	3	1	2	1

प्रश्न क्रमांक	उत्तरे			
	संच A	संच B	संच C	संच D
26	1	4	1	2
27	2	2	3	3
28	2	1	1	2
29	1	3	#	1
30	#	2	1	3
31	4	4	3	4
32	3	4	1	4
33	4	3	4	1
34	3	4	3	3
35	1	3	4	3
36	1	1	1	3
37	4	1	3	4
38	4	4	1	4
39	3	1	4	1
40	4	3	3	4
41	1	3	4	3
42	3	4	4	4
43	3	3	3	1
44	4	4	4	3
45	2	4	4	2
46	3	3	4	3
47	4	1	2	1
48	4	1	1	4
49	1	4	3	4
50	3	4	1	2

Date - 03 Oct, 2013

ने दर्शविलेले प्रश्न रद्द करण्यात आलेले आहेत.

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पेपर - I

प्रश्न क्रमांक	उत्तरे			
	संच A	संच B	संच C	संच D
51	1	2	4	3
52	1	2	2	1
53	2	3	2	4
54	2	4	1	4
55	1	4	3	1
56	4	1	1	1
57	4	2	4	2
58	4	1	4	4
59	2	2	2	1
60	3	4	3	3
61	4	1	4	2
62	3	2	2	3
63	2	2	4	4
64	1	2	1	3
65	2	3	3	2
66	3	3	1	3
67	1	3	3	1
68	3	4	3	3
69	3	3	3	2
70	4	1	3	3
71	3	3	2	2
72	2	3	2	4
73	3	3	3	3
74	1	1	1	1
75	3	1	3	3

प्रश्न क्रमांक	उत्तरे			
	संच A	संच B	संच C	संच D
76	1	2	2	3
77	1	1	3	1
78	1	3	1	3
79	2	3	3	2
80	2	1	1	3
81	1	3	3	1
82	3	2	1	1
83	3	3	2	3
84	3	1	3	2
85	3	3	3	3
86	3	3	1	1
87	4	4	4	1
88	4	2	2	1
89	4	4	2	4
90	1	3	4	3
91	4	2	1	2
92	3	1	4	3
93	4	1	4	2
94	2	4	4	3
95	2	4	4	4
96	4	3	3	3
97	1	3	3	4
98	3	4	1	4
99	3	3	3	4
100	3	4	3	4

Date - 03 Oct, 2013

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CODE : **KO2**

A

प्रश्नपुस्तिका क्रमांक
BOOKLET NO.

2013

प्रश्नपुस्तिका
स्थापत्य अभियांत्रिकी
पेपर-II

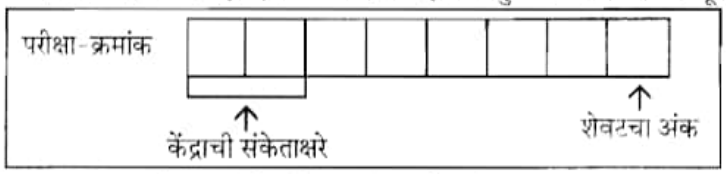
वेळ : 2 (दोन) तास

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. असा 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 सर्वांत 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.

(7) **प्रस्तुत परीक्षेच्या उत्तरपत्रिकांचे मूल्यांकन करताना उमेदवाराच्या उत्तरपत्रिकेतील योग्य उत्तरांनाच गुण दिले जातील. तसेच ''उमेदवाराने वस्तुनिष्ठ बहुपर्यायी स्वरूपाच्या प्रश्नांची दिलेल्या चार पर्यायांपैकी सर्वांत योग्य उत्तरेच उत्तरपत्रिकेत नमूद करावीत. अन्यथा त्यांच्या उत्तरपत्रिकेत सोडविलेल्या प्रत्येक चार चुकीच्या उत्तरांसाठी एका प्रश्नाचे गुण वजा करण्यात येतील''.**

पर्यवेक्षकांच्या सूचनेविना हे सील उघडू नये

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

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1. In the case of which natural feature do the two contour lines intersect ?

(1) hill (2) valley (3) saddle (4) vertical cliff

2. When L denotes the Latitudes and D denotes the departures, then the closing error is given by :

(1) $\frac{\Sigma L + \Sigma D}{2N}$ (2) $\frac{\Sigma L}{N} + \frac{\Sigma D}{N}$ (3) $\sqrt{\Sigma L + \Sigma D}$ (4) $\sqrt{\Sigma L^2 + \Sigma D^2}$

3. The line through a point in which plane passing through that point and the north and south poles, intersects with the surface of the earth is known as :

(1) True Bearing (2) True Meridian

(3) Arbitrary meridian (4) None of the above

4. The chainages of point of curvature and point of tangency of a simple circular curve are 1050.50 m and 1314.90 m respectively. The number of full chords for a peg interval of 30 m will be :

(1) 7 (2) 8 (3) 6 (4) 9

5. In plane table survey the method used for locating points is :

(1) Resection (2) Radiation

(3) Intersection (4) Either Radiation or Intersection

6. Which of the following statements are correct ?

(a) An echo - sounder is also called as a fathometer.

(b) A self -registering gauge should be installed in open.

(c) An echo - sounder can be used in strong currents.

Answer options :

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

(3) (a) and (b) (4) (b) and (c)

SPACE FOR ROUGH WORK

P.T.O.

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7. Overturning of a vehicle on a curve can be avoided by using :

(1) Transition curve (2) Vertical curve

(3) Reverse curve (4) Compound curve

---

8. Least count of a theodolite is :

(1) 1 minute (2) 30 minutes (3) 1 degree (4) 20 seconds

---

9. If the magnetic bearing of a line is 54°30' and magnetic declination is 5°30' E, the true bearing of line will be :

(1) 61° (2) 59° (3) 49° (4) 60°

---

10. The process of determining the difference of elevations of stations from vertical angles and known distances , is known as :

(1) Trigonometrical levelling (2) Geodetic surveying

(3) Field astronomy (4) Topographic surveying

---

11. The method of tacheometric surveying in which stadia hairs are not used and the readings are taken against the horizontal cross hair with measurement of vertical angle twice for one single observation is known as :

(1) Substance method (2) Tangential system

(3) Fixed hair method (4) None of the above

---

12. Arithmatic check in levelling indicates :

(1) Accuracy of field work (2) Correctness of computations

(3) Instrumental error (4) Error in staff readings

SPACE FOR ROUGH WORK

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13. In Global Positioning System (G.P.S.) there are more than 24 Nos. of G.P.S. Satellites moving in circular orbits around the earth with the inclination of :

(1) 65° (2) 35° (3) 45° (4) 55°

---

14. For building project estimates which method is generally used in PWD ?

(1) Long wall and Short wall method (2) Centre line method

(3) Crossing method (4) None of the above

---

15. A building was constructed 20 years ago at ₹ 50,000. The estimated life of the building is 90 years. What is the present value of the building using straight - line method ? Use 10% scrap value

(1) ₹ 40,000 (2) ₹ 38,888 (3) ₹ 45,000 (4) ₹ 35,000

---

16. The quantity of arch masonry work is calculated by the relation :

(1) Span of arch × breadth of wall × thickness of arch

(2) (Span of arch + 2 × thickness of arch) × breadth of wall

(3) (Span of arch + 2 × breadth of wall) × thickness of arch

(4) Mean length of arch × breadth of wall × thickness of arch

---

17. The work output of a mason for brick work in cement mortar for foundation work is roughly expected to be :

(1) 0.5 cu.m. per day (2) 1.25 cu.m per day

(3) 2.00 cu.m. per day (4) 5.00 cu.m. per day

SPACE FOR ROUGH WORK

P.T.O.

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18. Security deposit deducted at 5% from contractors bills is :

(1) refunded when the contractor completes the work.

(2) refunded even before the completion of the work provided good progress has been established

(3) retained till the expected life of structure and spent for maintenance

(4) refunded when the defect liability period of six months or one monsoon whichever is later is over.

---

19. Which of the following documents will not be required for drafting the tender notice ?

(1) Nature of work and its location (2) Estimated cost of the work

(3) Schedule - A of the work (4) Mode of submitting tender

---

20. The rate of a particular item of work depends on :

(a) Specifications of works and materials.

(b) Quantities of materials and their rates.

(c) Location of the site of work.

(d) Profit and overhead expenses of contractor.

Answer options :

(1) (a) and (b) (2) only (d)

(3) (a), (c) and (d) (4) (a), (b), (c) and (d)

---

21. The brick work is not measured in m^3 in case of :

(1) One or more than one brick thick wall.

(2) Half brick thick wall.

(3) Brick work in arches.

(4) Reinforced brick work.

SPACE FOR ROUGH WORK

Scanned with CamScanner

22. The method used for valuation of building is :

(1) Rental method of valuation (2) Depreciation method of valuation

(3) Valuation based upon cost (4) Any of the above

---

23. Which of the following represents the requirements of valid contract :

(a) It must be in writing

(b) Can be enforced in court of law

(c) Parties should give the consent for agreement

(d) Parties concerned must be competent

Answer options :

(1) (a) and (b) of the above (2) (a) and (c) of the above

(3) (c) and (d) of the above (4) (a), (b), (c) and (d) of the above

---

24. Find the specific gravity of soil grains with the help of a pycnometer if, weight of solids = 100 g, weight of pycnometer + soil + water = 610 g, weight of pycnometer + water = 550 g.

(1) 2.40 (2) 2.50 (3) 2.60 (4) 2.70

---

25. The active earth pressure for 10 m high retaining wall supporting a cohesionless backfill with unit weight of 19.0 kN/m^3 and angle of frictional resistance as 30°, if water table is upto top of wall, is :

(Consider unit weight of water = 10 kN/m^3)

(1) 330 kN/m (2) 1326 kN/m

(3) 166.67 kN/m (4) 650 kN/m

SPACE FOR ROUGH WORK

Scanned with CamScanner

26. Cofferdam is a :

(1) type of earthen dam for storage of water

(2) type of bridge foundation

(3) temporary enclosure in a river to create dry working area during construction

(4) permanent structure to store water during floods

---

27. Compactive energy used for modified proctor test is how many times the compactive energy used in standard proctor test :

(1) 2.5′ (2) 3.5′ (3) 4.5′ (4) 5.5′

---

28. In the method of slices used for analysing the stability of slopes ; each slice is assumed to be rectangular with a base in the shape of :

(1) Straight line (2) Log spiral (3) Arc of circle (4) Parabolic arc

---

29. The critical height of vertical excavation that can be made without any lateral support for a cohesive soil having unit weight of 19.2 kN/m^3, unit cohesion as 12 kN/m^2 and $\phi = 10°$, is :

(1) 1.49 m (2) 2.98 m (3) 4.47 m (4) 5.96 m

---

30. A footing of 4m × 2m in plan, transmit a pressure of 200 kN/m^2 on a cohesive soil having $F = 6 \times 10^4$ kN/m^2 and $\mu = 0.5$. The immediate settlement of the footing at the centre assuming rigid footing and $I_f = 1.2$, is :

(1) 5 mm (2) 6 mm (3) 12 mm (4) 10 mm

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31. During ocdometer tests on soils, the permeability of a saturated clay may be obtained from :

(a) Voids ratio with the change in applied load.

(b) Voids ratio with the change in logarithm of the applied load.

(c) Unit weight of water and degree of consolidation.

(d) Unit weight of water and coefficient of consolidation.

Which of the following options is correct :

(1) Both (a) and (d) (2) Both (a) and (c)

(3) Both (b) and (c) (4) Both (a) and (b)

---

32. If saturated clay mass is sheared with normal stress of 220 kPa and pure water pressure of 120 kPa, the result gives $C' = 12$ kPa and $\phi' = 45°$. The shear strength in terms of effective stress is :

(1) 139 kPa (2) 69.7 kPa (3) 81.28 kPa (4) 112 kPa

---

33. The water content corresponding to maximum density is :

(1) Optimum water content (2) Maximum water content

(3) Least water content (4) Zero water content

---

34. Coefficient of discharge for an orifice is _____ of coefficient of velocity and coefficient of contraction.

(1) an addition (2) a difference (3) a product (4) a ratio

---

35. Reciprocating pump belongs to which of the following types ?

(1) Rotary pump (2) Propeller pump

(3) Mixed flow pump (4) Displacement pump

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36. For incompressible fluids in which of the following cases hydrostatic pressure remains constant ?

(1) along horizontal plane

(2) along vertical plane

(3) along both horizontal and vertical planes

(4) along inclined plane making an angle of 45° with the horizontal

---

37. In which of the following cases streamline, streak line and pathline will coincide with each other ?

(1) Steady flow (2) Unsteady flow

(3) Laminar flow (4) Turbulent flow

---

38. For steady uniform flow in prismatic channel, which of the following statements is true ?

(1) Slope of energy line is more than slope of channel bed

(2) Slope of energy line is same as slope of channel bed

(3) Slope of energy line is more than slope of free surface

(4) Slope of energy line is more than slope of channel bed but less than slope of free surface.

---

39. Which of the following terms are used to indicate vertical distance between energy grade line and hydraulic grade line at any point of flow at given section :

(1) Piezometric head (2) Velocity head

(3) Elevation head (4) Total head

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40. Which of the following is the cause for separation of boundary layer ?

(1) Positive pressure gradient

(2) Negative pressure gradient

(3) Boundary layer thickness reducing to zero

(4) Laminar flow changing to turbulent flow

---

41. Bernoullis equation in it's original form is applicable to which of the following types of flow ?

(1) flow along a streamline (2) flow of an ideal fluid

(3) steady flow (4) all the above

---

42. Which of the following is correct dimension for dynamic viscosity ?

(1) MLT^{-1} (2) ML^2T^{-1} (3) $ML^{-1}T^{-1}$ (4) $ML^{-1}T^{-2}$

---

43. Newtonian fluids satisfy which of the following equations ?

(1) $\tau = \mu \left(\frac{du}{dy}\right)^2$ (2) $\tau = \tau_c + \mu \left(\frac{du}{dy}\right)$

(3) $\tau = \mu \cdot \frac{du}{dy}$ (4) $\tau = \tau_c + \mu \left(\frac{du}{dy}\right)^2$

---

44. If the maximum depth of 50 years 10 h - rainfall depth at Nanded is 150 mm, the 50 years 4 h maximum depth at the same place is :

(1) < 150 mm (2) > 150 mm

(3) = 150 mm (4) Inadequate data

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45. A culvert is designed for a peak flow Q_P on the basis of the rational formula. If a storm of the same intensity as used in the design but of duration twice larger occurs, the resulting peak discharge will be :

(1) Q_P (2) $2Q_P$ (3) $Q_P/2$ (4) $(Q_P)^2$

---

46. A unit hydrograph has _____ .

(1) One unit of peak discharge

(2) One unit of rainfall duration

(3) One unit of direct runoff

(4) One unit of the time base of direct runoff

---

47. The Muskingum method of flood routing is a :

(1) hydrologic channel routing method

(2) form of reservoir routing method

(3) hydraulic routing method

(4) complete numerical solution of St. Venant equations

---

48. Surcharge storage in a reservoir is the volume of storage between :

(1) minimum pool level and normal pool level

(2) normal and maximum pool level

(3) dead storage level and maximum storage level

(4) minimum and average pool level

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49. In routing a flood through a reach, the point of intersection of inflow and outflow hydrographs coincides with the peak of out flow hydrograph :

(1) in all the cases of flood routing

(2) when the inflow is into a reservoir with an uncontrolled outlet

(3) in channel routing only

(4) in all cases of reservoir routing

---

50. The discharge per unit drawdown at a well is known as :

(1) Specific yield (2) Specific storage

(3) Safe yield (4) None of these

---

51. If S_y = specific yield and S_r = specific retention, then :

(1) $S_y + S_r = 0.50$ (2) $S_y + S_r$ = Porosity

(3) $S_y + S_r = 1.0$ (4) $S_y + S_r$ = Permeability

---

52. An acquifer confined at the bottom but not at the top is called :

(1) Semiconfined acquifer (2) Unconfined acquifer

(3) Confined acquifer (4) Perched acquifer

---

53. The use of the unit hydrograph for estimating floods is limited to catchments of size less than :

(1) 5000 km^2 (2) 500 km^2 (3) 10^4 km^2 (4) no upper limit

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54. Darcy's law is valid in a porous media flow if the Reynolds number (Re) is less than unity. This Reynolds number is obtained by :

(1) (discharge velocity × maximum grain size)/μ

(2) (actual velocity × average grain size)/ν

(3) (discharge velocity × average grain size)/ν

(4) (discharge velocity × pore size)/ν

---

55. An isochrone is a line on the basin map :

(1) Joining raingauge stations with equal rainfall duration

(2) Joining points having equal standard time

(3) Connecting points having equal time of travel of the surface runoff to the catchment outlet

(4) That connects points of equal rainfall depth in a given time interval

---

56. According to Dr. Khosla's theory, the exit gradient in the absence of a downstream cutoff is :

(1) zero (2) infinity (3) unity (4) very large

---

57. Uplift pressure on the dam :

(1) virtually increases the downward weight of the body of the dam

(2) increases the stability of dam

(3) virtually decreases the downward weight of the body of the dam

(4) has no effect on the stability of dam

---

58. Spillway is a structure constructed at a dam site for :

(1) effectively disposing of dead storage for drinking water

(2) effectively disposing of surplus water on downstream side

(3) effectively disposing of water in canal for irrigation

(4) storage of surplus water during floods

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59. What does an earthquake acceleration of 0.15 g acting vertically downward in a gravity dam cause ?

(1) an increase in the weight of dam by 15%

(2) reduction in unit weight of concrete only by 15%

(3) decrease in unit weight of concrete and water by 15%

(4) increase in uplift pressure by 15%

---

60. Elementary profile of a gravity dam will be right-angled triangle having zero width at the water level and a base width (B) at bottom :

(1) When subjected to water pressure on upstream side only

(2) When subjected to water pressure and silt pressure

(3) When subjected to silt pressure on upstream side only

(4) When subjected to Ice pressure on upstream side only

---

61. The meander ratio is the ratio of :

(1) the length of the river channel to the axial length of the river

(2) the axial length of the river to the length of the river channel

(3) the meander length to the meander belt

(4) the meander belt to the meander length

---

62. The following data is available for a cross drainage project :

Parameter	Canal	Drainage
FSL(m)	110	109
Bedlevel (m)	105	107
Discharge (m^3/s)	90	15

The most appropriate cross drainage work for this situation is :

(1) syphon aqueduct (2) syphon

(3) super passage (4) aqueduct

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63. At the base of a gravity dam section, the vertical stress at the toe is 4 MPa. The slope of downstream face of dam is 0.707 horizontal : 1 vertical. If there is no tail water, the major principal stress at the toe is :

(1) 4 MPa (2) 5 MPa (3) 6 MPa (4) 8 MPa

---

64. In a solid-roller bucket type energy dissipator, the energy dissipation is :

(1) due to formation of a hydraulic jump.

(2) due to interaction of free jet with air and due to impact on downstream channel bed.

(3) due to interaction of two complementary rollers.

(4) due to lateral spreading of the jet and partly due to interaction of two rollers.

---

65. Identify the correct statements :

The ski-jump energy dissipator is used usually when :

(a) the tail water level is too low for hydraulic jump to form

(b) the bed of the stream is of sound rock

(c) the erosion from the jet is not a problem for the safety of the structure

(d) there is considerable air entrainment of the flow by the time it reaches the bucket

Answer options :

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

(3) (a), (b) and (d) (4) (a), (b) and (c)

---

66. The perimeter of a regime channel having width B and depth D is :

(1) $B + \sqrt{2}\,D$ (2) $B + 2\sqrt{2}\,D$ (3) $B + \sqrt{5}\,D$ (4) $B + 2\sqrt{5}\,D$

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67. Groynes are constructed to :

(1) control the river flood

(2) protect the bank from which they are extended

(3) permit the construction in flowing river

(4) ensure effective disposal of sediment load

---

68. In a saddle -siphon spillway, an air vent is provided at the level of the full reservoir surface :

(1) to break the siphonic action at that level.

(2) to initiate the siphonic action at that level.

(3) to prevent cavitation.

(4) to maintain ventilation inside the siphon.

---

69. PIEV theory is related to :

(1) Accident study (2) Pavement design

(3) Sight distance study (4) Origin and Destination study

---

70. Specific gravity of pure bitumen is in the range of :

(1) 1.10 to 1.25 (2) 1.25 to 1.40 (3) 0.97 to 1.02 (4) Less than 1.0

---

71. Super elevation to be provided in horizontal curves of radius R in hill roads is given by :

(1) $V^2/127R$ (2) $V^2/17.5\ R$ (3) $V^2/225R$ (4) $(V+8)^2/127R$

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72. Organisations/ Institutions involved with Road Development in India are :

(1) NHAI, IRC, BRO (2) NHAI, IRC, BCI

(3) IRC, HRB, BCI (4) NHAI, HRB, BCI

---

73. IRC has fixed the maximum limit of super elevation for mixed traffic in plain and rolling terrain as

(1) 10% (2) 7% (3) 5% (4) 4%

---

74. In hot climates, bitumen of what penetration grade is preferred ?

(1) 80/100 (2) 60/70

(3) 30/40 (4) None of the above

---

75. Pavements of major roads should be designed for atleast a life period of :

(1) 5 years (2) 10 years (3) 20 years (4) 30 years

---

76. In flexible pavement design by Group Index method, for constant value of traffic volume, higher the value of G.I pavement thickness requirement would be :

(1) More (2) Less (3) Same (4) None of the above

---

77. The centrifugal force is acting on a vehicle negotiating a :

(1) Railway track crossing (2) River crossing

(3) Vertical curve (4) Horizontal curve

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78. Origin and Destination studies are carried out for :

(1) Planning of road network for vehicular traffic

(2) Accident studies

(3) Pavement Design

(4) Geometric Design

---

79. The minimum stopping sight distance on single lane roads with two - way traffic movements is :

(1) 2 × SSD (2) 0.5 × SSD (3) 4 × SSD (4) equal to SSD

---

80. On a rightangled road intersection with two -way traffic, the total number of conflict points are :

(1) 24 (2) 11 (3) 6 (4) 4

---

81. Approach on either side of a bridge will have a minimum straight length of :

(1) 5 mt (2) 15 mt (3) 50 mt (4) 150 mt

---

82. The selection of site for road bridges depends on :

(1) Nature of river banks and appropriate arches

(2) Width and depth of river at site to be bridged

(3) Availability of good and safe foundation for bridge

(4) All of the above

---

83. In class 70 - R loading, the minimum spacing between vehicles is :

(1) 30 m (2) 40 m (3) 60 m (4) 70 m

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84. A temporary enclosure built to exclude water from the working area and to provide free access to the area within, during the construction of a foundation or other structures that may be undertaken below water level is known as :

(1) Shell (2) Cofferdam

(3) Caissions (4) Any of the above

---

85. When is the span of the bridge economic ?

(1) When the cost of supporting system of one span is equal to cost of one pier

(2) When the cost of supporting system of one span is equal to cost of one abutment

(3) When the cost of one pier is equal to half the cost of abutment

(4) When the cost of supporting system of one span is equal to twice the cost of pier

---

86. The stream at the ideal bridge site should be :

(1) Well defined and as deep as possible

(2) Well defined and as wide as possible

(3) Well defined and as narrow as possible

(4) Deep and as wide as possible

---

87. The small submersible bridge having no openings is known as :

(1) Cause way (2) Dead end bridge

(3) Irish bridge (4) Either (1) or (3)

---

88. Suspension bridges are :

(1) Movable bridges (2) Suitable for long spans

(3) Suitable for short spans (4) Used over navigable channels

---

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89. The wall which is a splayed extension of an abutment of a slope of the embankment is called _____ :

(1) Retaining wall (2) Parapet wall (3) Support wall (4) Wing wall

---

90. Strengthening of bridges is done for :

(1) Safety against earthquake (2) Safety during floods

(3) Old bridges (4) Newly constructed bridges

---

91. Match List I (Method of disposal) with List II (Terms related to method) :

	List I		List II
(a)	Sanitary land fill	(i)	High operational and maintenance cost
(b)	Incineration	(ii)	Leachate collection and treatment
(c)	Composting	(iii)	Pre-sorting, grinding and turning
(d)	Salvage by seggregation	(iv)	Suitable for recyclable wastes

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

---

92. Time of concentration is relevant to determine the design of _____ :

(1) Storm sewer

(2) Sanitary sewer

(3) Both storm and sanitary sewers

(4) Neither storm sewer nor sanitary sewer

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93. The relation between BOD and COD IS :

(1) BOD is always less than COD.

(2) BOD is greater than COD.

(3) BOD is equal to COD.

(4) There is no relation between BOD and COD.

---

94. Which of the following are the methods of treatment and disposal of biomedical waste ?

(1) Hydroclave method (2) Autoclave method

(3) Incineration (4) All the above

---

95. What is the typical moisture content range of Municipal Solid Waste (MSW) for Indian conditions ?

(1) 25 to 40% (2) 45 to 60% (3) 62 to 70% (4) 5 to 15%

---

96. Which one of the following methods can be employed for solid waste excluding garbage ?

(1) Composting (2) Incineration

(3) Engineered land fill (4) Pyrolysis

---

97. Assertion (A) : If the intake is to be located on the curve, it should be located on the concave bank and not on the convex bank.

Reasoning (R) : The scouring tendencies will be more on the convex bank of the river

Select the answer from the following :

(1) Both (A) and (R) are correct and (R) is the correct explanation of (A).

(2) Both (A) and (R) are correct but (R) is not the correct explanation of (A).

(3) (A) is true but (R) is false.

(4) (A) is false but (R) is true.

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98. What is the treatment for removal of color due to colloidal organic matter :

(1) Aeration

(2) Primary sedimentation

(3) Co-agulation at low pH with alum salts

(4) All the above

---

99. In London Smog episode, which was the responsible pollutant ?

(1) Carbon monoxide (2) Oxides of Nitrogen

(3) Sulphur dioxide (4) Ozone

---

100. Which of the following statements are not correct in relation to water distribution system ?

(a) Tree system requires more number of valves and length of pipe.

(b) Reticulation system has multiple flow paths and pressures are equalised.

(c) Hardy-Cross method is used to analyze both tree and reticulation systems.

Answer options :

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

- o 0 o -

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परीक्षेचे नांव : महाराष्ट्र अभियांत्रिकी (स्थापत्य) सेवा, गट - ब (मुख्य) परीक्षा - 2013

परीक्षेचा दिनांक : 31 ऑगस्ट व १ सप्टेंबर 2013 विषय : (प्रश्नपत्रिका क्र. ३) स्थापत्य अभियांत्रिकी - पेपर - II

महाराष्ट्र अभियांत्रिकी सेवा (स्थापत्य), गट- ब (मुख्य) परीक्षा - २०१३ या स्पर्धा परीक्षेच्या प्रश्नपत्रिकेची उत्तरतालिका उमेदवारांच्या माहितीसाठी संकेतस्थळावर प्रसिध्द करण्यात आली होती. त्यासंदर्भात उमेदवारांनी अधिप्रमाणित (Authentic) स्पष्टीकरण / संदर्भ देऊन पाठविलेली लेखी निवेदने, तसेच तज्ज्ञांचे अभिप्राय विचारात घेऊन आयोगाने उत्तरतालिका सुधारित केली आहे. या उत्तरतालिकेतील उत्तरे अंतिम समजण्यात येतील. यासंदर्भात आलेली निवेदने विचारात घेतली जाणार नाहीत व त्याबाबत कोणताही पत्रव्यवहार केला जाणार नाही, याची कृपया नोंद घ्यावी.

उत्तरतालिका - KEY

पेपर - II

प्रश्न क्रमांक	उत्तरे			
	संच A	संच B	संच C	संच D
1	4	2	4	2
2	4	4	4	1
3	2	4	4	4
4	1	4	1	1
5	4	4	2	2
6	2	2	4	4
7	1	2	4	1
8	4	1	1	4
9	4	4	2	4
10	1	2	4	4
11	2	1	2	2
12	2	4	1	4
13	4	1	2	2
14	1	2	3	2
15	1	4	**2**	1
16	4	4	1	4
17	**2**	1	4	1
18	4	3	4	4
19	3	4	4	4
20	4	4	2	3
21	2	**2**	4	4
22	4	1	4	4
23	4	4	1	**2**
24	2	3	2	2
25	**3**	4	**3**	3

प्रश्न क्रमांक	उत्तरे			
	संच A	संच B	संच C	संच D
26	3	2	2	2
27	3	3	1	3
28	1	1	2	2
29	2	1	1	1
30	2	**3**	4	**3**
31	4	2	3	4
32	4	2	3	4
33	1	4	4	1
34	3	4	2	1
35	4	2	2	3
36	1	1	4	3
37	1	3	3	2
38	2	4	4	1
39	2	1	1	1
40	1	1	3	4
41	4	3	1	4
42	3	2	1	3
43	3	3	3	2
44	1	2	1	1
45	1	1	3	4
46	3	2	1	2
47	1	2	3	2
48	2	4	1	1
49	2	3	2	2
50	4	1	3	3

Date - 03 Oct, 2013

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प्रश्न क्रमांक	उत्तरे			
	संच A	संच B	संच C	संच D
51	2	3	2	1
52	2	1	2	2
53	1	2	2	3
54	3	3	4	3
55	3	1	1	1
56	2	4	2	1
57	3	3	2	1
58	2	2	3	2
59	3	3	1	3
60	1	4	2	4
61	4	3	3	3
62	1	2	1	1
63	3	1	3	3
64	3	3	3	4
65	4	1	1	2
66	3	3	3	2
67	2	1	4	3
68	1	2	4	3
69	3	3	4	1
70	3	4	3	2
71	3	1	2	3
72	1	1	2	2
73	2	2	3	1
74	3	3	3	1
75	2	1	1	4

प्रश्न क्रमांक	उत्तरे			
	संच A	संच B	संच C	संच D
76	1	3	3	1
77	4	2	1	1
78	1	3	1	3
79	1	1	1	3
80	1	1	1	3
81	2	4	4	2
82	4	3	3	1
83	1	2	2	2
84	2	2	2	4
85	1	1	1	4
86	3	1	4	4
87	4	4	1	2
88	2	3	3	1
89	4	2	2	3
90	3	4	4	3
91	4	4	4	4
92	1	3	1	4
93	1	4	3	3
94	4	3	1	4
95	1	3	3	1
96	3	1	4	3
97	3	4	3	3
98	3	1	1	3
99	3	3	4	1
100	4	1	3	1

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महाराष्ट्र अभियांत्रिकी सेवा (स्थापत्य) (मुख्य) परीक्षा - 2015
परीक्षा दिनांक - 9 व 10 जानेवारी, 2016

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2016

CODE : **BO7**

प्रश्नपुस्तिका क्रमांक
BOOKLET NO.

प्रश्नपुस्तिका-II

वेळ : 2 (दोन) तास

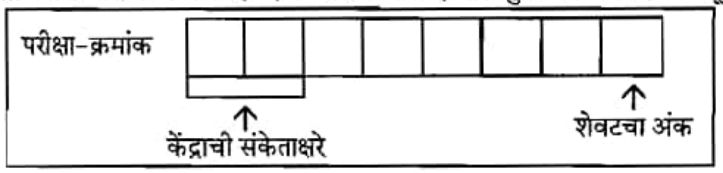
स्थापित्य अभियांत्रिकी पेपर-1

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. असा 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. वास्तव 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.

(7) **प्रस्तुत परीक्षेच्या उत्तरपत्रिकांचे मूल्यांकन करताना उमेदवाराच्या उत्तरपत्रिकेतील योग्य उत्तरांनाच गुण दिले जातील. तसेच ''उमेदवाराने वस्तुनिष्ठ बहुपर्यायी स्वरूपाच्या प्रश्नांची दिलेल्या चार पर्यायापैकी सर्वात योग्य उत्तरेच उत्तरपत्रिकेत नमूद करावीत. अन्यथा त्यांच्या उत्तरपत्रिकेत सोडविलेल्या प्रत्येक चार चुकीच्या उत्तरांसाठी एका प्रश्नाचे गुण वजा करण्यात येतील''.**

पर्यवेक्षकांच्या सूचनेविना हे सील उघडू नये

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

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1. Which of the following is not a test for measuring workability of concrete ?

(1) Slump Test (2) Flow Test

(3) Std. Consistency Test (4) Kelly Ball Test

2. The stone whose crushing strength is maximum, is :

(1) granite (2) chalk (3) slate (4) marble

3. As per the Building Byelaws, how much should be the marginal distance that is to be left in the front ?

(1) At least 3 m (2) At least 5 m

(3) More than 5 m (4) More than 10 m

4. Generally at what rate should slip form be lifted ?

(1) 1 m per hour (2) 5 - 10 cm per hour

(3) 20 - 30 cm per hour (4) 50 - 60 cm per hour

5. What is a Mullion in a window shutter ?

(1) Vertical member running through shutter of window.

(2) Horizontal member of shutter.

(3) Inclined battening.

(4) None of the above

6. How much is the covering capacity of cement paint ?

(1) About 18 m^2/kg per coat (2) About 20 m^2/kg per coat

(3) About 12 m^2/kg per coat (4) About 4 m^2/kg per coat

7. As per IS specifications, the heat of hydration of low-heat portland cement for 28 days is :

(1) Not more than 100 calories/gm (2) Not more than 50 calories/gm

(3) Not more than 75 calories/gm (4) Not more than 150 calories/gm

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8. Which of the following is not a principle of _____ planning ?

(1) Aspect (2) Floor Area Ratio

(3) Roominess (4) Prospect

9. To what, is Ease related in concrete technology ?

(1) Geology of fresh concrete (2) Rheology of fresh concrete

(3) Mineralogy of fresh concrete (4) Ecology of fresh concrete

10. What does not fit into the classification of pile based on function ?

(1) Bearing pile (2) Friction pile

(3) Compaction pile (4) Steel pile

11. Acceptable noise level in dB for auditorium is :

(1) 25 to 30 (2) 40 to 45 (3) 35 to 40 (4) 45 to 55

12. Cavity or hollow space in a wall is provided for :

(a) Prevention of dampness (b) Heat insulation

(c) Sound insulation (d) Efflorescence

Answer options :

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

(3) (a), (b) and (d) (4) (a), (b), (c) and (d)

13. If a solid shaft is subjected to a torque (T) at its end such that maximum shear stress does not exceed f_s, the diameter of the shaft will be :

(1) $\frac{16\,T}{\pi f_s}$ (2) $\left(\frac{16\,T}{\pi f_s}\right)^{\frac{1}{2}}$ (3) $\left(\frac{16\,T}{\pi f_s}\right)^{\frac{1}{3}}$ (4) None of these

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14. Maximum deflection of a cantilever due to pure moment 'M' at its free end, is :

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

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

(1) Critical load (2) Crippling load (3) Buckling load (4) All of these

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

(1) Maximum at centre to zero at circumference

(2) Maximum at centre to minimum (Not Zero) at the circumference

(3) Zero at centre to maximum at circumference

(4) Minimum (Not Zero) at centre to maximum at circumference

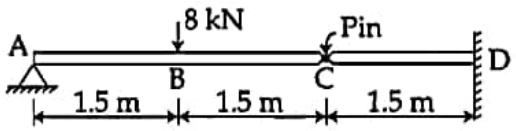
17. The ratio of the flexural strengths of two beams of square cross section, the first beam being placed with its top and bottom sides horizontally and second beam being placed with one diagonal horizontally, is :

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

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

(1) 0.125 (2) 0.250 (3) 0.375 (4) 0.500

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



(1) $\frac{2.25}{EI}$ (2) $\frac{4.5}{EI}$ (3) $\frac{6.75}{EI}$ (4) $\frac{8}{EI}$

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

(1) circular beam is more economical

(2) square beam is more economical

(3) both the beams are equally strong

(4) both the beams are equally economical

---

21. Two rods of different materials having coefficient of linear expansion α_1, α_2 and Young's moduli E_1, E_2 respectively are fixed between to massive walls. The rods are heated such that they undergo the same increase in temperature. There is no bending of the rods. If $\alpha_1 : \alpha_2 = 2 : 3$, the thermal stresses are equal, what is the ratio of E_1 to E_2 ?

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

---

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

(1) yielding (2) creeping

(3) breaking (4) none of the above

---

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

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

---

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

(1) Ordinary moment resisting frame

(2) Intermediate moment resisting frame

(3) Special moment resisting frame

(4) All of the above

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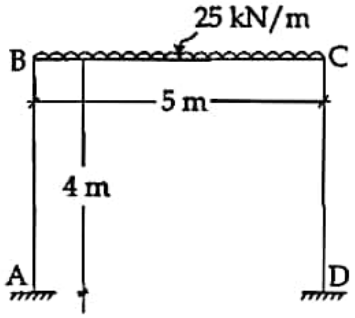
25. A fixed base symmetrical frame is shown in the figure write slope deflection equation for moment at B for member AB :



(1) $M_{BA} = 0.5\ EI.\theta_B$ (2) $M_{BA} = EI.\theta_B$

(3) $M_{BA} = 0.5\ EI.\theta_A$ (4) $M_{BA} = EI.\theta_A$

---

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

(1) 9.87 kN at fixed end and 6.13 kN at simply supported end

(2) 8 kN each at fixed end and simply supported end

(3) 11 kN at fixed end and 5 kN at simply supported end

(4) 16 kN at fixed end and zero kN at simply supported end

---

27. Fill in the blanks :

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

(1) rotational and translational displacements, joint force equilibrium

(2) moment and forces, compatibility

(3) stiffness and flexibility, differential

(4) none of the above

---

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

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

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

(1) 0.2 (2) 1.67 (3) 0.6 (4) 0.15

---

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

(1) $\frac{3}{16}$ W (2) $\frac{W}{4}$ (3) $\frac{5}{16}$ W (4) $\frac{7}{16}$ W

---

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

(1) shall be affected due to rotation and sinking

(2) shall not be affected due to rotation and sinking

(3) reaction at A shall change but reaction at B shall not change due to rotation and sinking

(4) none of the above

---

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

(1) $K = \frac{3EI}{L}$ (2) $K = \frac{4EI}{L}$ (3) $K = \frac{EI}{L}$ (4) $K = \frac{L}{EI}$

---

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

Lenght = 8.00 m Area = 11.25×10^{-3} m^2

Internal force resisted by member under actual loading condition = 450 kN (compression)
modulus of elasticity = 200×10^6 kN/m^2

Internal force after unit load application = 0.0 kN

(1) −0.5 mm (2) +0.5 mm (3) −1.6 mm (4) Zero

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34. A continuous beam ABCD has end A as fixed and support B and C are simple supports while end D is free. The fixed end moments for beam AB are $FEM_{AB} = -19.2$ kNm and $FEM_{BA} = 28.8$ kNm. The moment equation for slope deflection method for beam AB can be written as :

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

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

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

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

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

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

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

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

---

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

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

Where 'm' = the number of unknown member forces

'r' = unknown reaction components and

'j' = the number of joints.

---

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

(1) Same (2) Different

(3) Zero (4) None of the above

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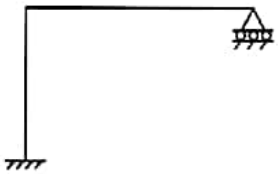
37. If k_i is the stiffness of i^{th} member at a joint, the distribution factor for the member is :

(1) k_i (2) $\frac{k_i}{\Sigma k_i}$ (3) Σk_i (4) $(\Sigma k_i - k_i)$

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



(1) KI = 1 (2) KI = 2 (3) KI = 3 (4) KI = 5

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

$M_{DB} = 0.4\ EI\ \theta_B$ $M_{BD} = 0.8\ EI\ \theta_B$

$M_{BA} = 54$ $M_{BC} = -135 + 1.6\ EI\ \theta_B$

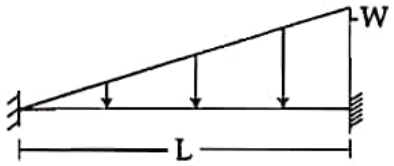
$M_{CB} = 135 + 1.6\ EI\ \theta_B$ then

θ_B rotation at B is given by :

(1) $\frac{-112.5}{EI}$ (2) $\frac{33.75}{EI}$

(3) Zero (4) None of the above

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



(1) $-\frac{WL^2}{10}$ and $+\frac{WL^2}{20}$ (2) $-\frac{WL^2}{30}$ and $+\frac{WL^2}{20}$

(3) $+\frac{WL^2}{20}$ and $-\frac{WL^2}{30}$ (4) $-\frac{WL^2}{15}$ and $-\frac{WL^2}{15}$

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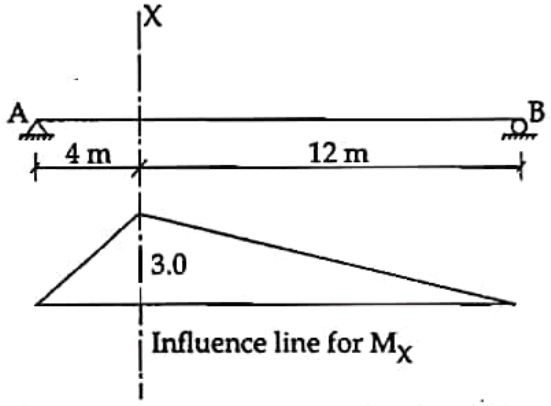
41. If unit load moves from left to right on S.S. beam the nature of ILD for reaction is :
(1) Parabolic (2) Hyperbolic
(3) Horizontal Straight Line (4) Inclined Straight Line

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

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



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

44. A continuous beam has AB as one of the spans. It is subjected to fixed end moments at end A and B as FEM_A and FEM_B respectively under given loads. It has length 'L' and flexural rigidity EI. It rotates at end A and B by θ_A and θ_B respectively. The member axis rotates through clockwise angle $R = \frac{\Delta}{L}$. The moment at end A is given by :

(1) $M_A = FEM_B + \frac{4EI}{L}(2\theta_A + \theta_B - 3R)$

(2) $M_A = FEM_A + \frac{2EI}{L}(2\theta_A + \theta_B - 3R)$

(3) $M_A = FEM_A + \frac{4EI}{L}(2\theta_A + \theta_B + 3R)$

(4) None of the above

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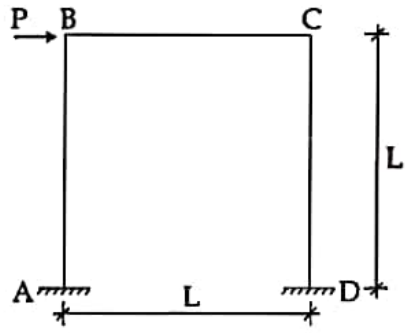
45. What is the shear equation in slope deflection method for the portal frame shown below ?



(1) $\frac{M_{AB} + M_{BA}}{L} + \frac{M_{CD} + M_{DC}}{L} + P = 0$

(2) $\frac{M_{AB} + M_{BA}}{L} + \frac{M_{BC} + M_{CB}}{L} + P = 0$

(3) $\frac{M_{BC} + M_{CB}}{L} + \frac{M_{CD} + M_{DC}}{L} + P = 0$

(4) $\frac{M_{BC} + M_{CB}}{L} + P = 0$

---

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

(1) $\frac{f_{sb}}{f_{asb}} + \frac{f_{tb}}{f_{atb}} \leq 1.0$

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

(3) $\frac{f_{sb}}{f_{asb}} + \frac{f_{tb}}{f_{atb}} \leq 1.4$

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

---

47. The failure of a column depends upon :

(1) weight of a column

(2) length of column

(3) slenderness ratio

(4) cross sectional area of column

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48. In which form is the permissible stress in columns, f by Merchant - Rankine's formula ?

(1) $f \propto \frac{\pi^2 E}{\lambda^2}$ (2) $f \propto \frac{f_y}{1 + 0.2 \sec\left(c.\lambda.\sqrt{f}\right)}$

(3) $\frac{1}{(f)^n} \propto \frac{1}{(f_y)^n} + \frac{1}{(f_{cr})^n}$ (4) $f \propto \frac{f_y}{\phi + \sqrt{\phi^2 - \lambda^2}}$

---

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

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

---

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

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

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

---

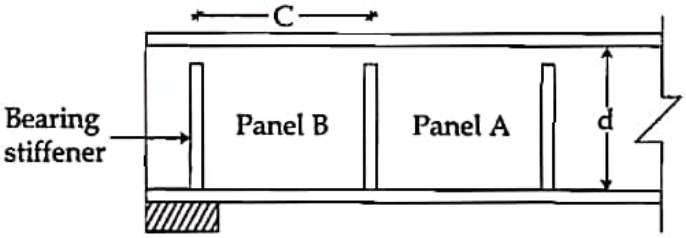
51. The effective throat thickness of a fillet weld depends upon :

(1) angle between fusion faces (2) length of weld

(3) permissible shear stress (4) type of weld

---

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



(1) Simple post critical action (2) Tension field action

(3) Bearing force action (4) None of the above

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

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

---

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

(a) Very low carbon steels, < 0.1%

(b) Low carbon steel 0.1 to 0.25%

(c) Medium carbon steel 0.25 to 0.6%

(d) High carbon steel 0.6 to 1.1%

Answer options :

(1) (a) is true (2) (a) and (b) are true

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

---

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

(1) length of continuous full size weld.

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

(3) overall length of weld minus four times the size of weld.

(4) overall length of weld plus twice the size of weld.

---

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

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

---

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

(1) Lap splices shall not be used for bars larger than 30 mm diameter.

(2) For flexure tension ; Lap length = Ld or 30 ϕ whichever is greater.

(3) For direct tension ; Lap length = 2 Ld or 24 ϕ whichever is greater.

(4) For compression members ; Lap length = Ld or 30 ϕ whichever is greater.

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58. Dead weight of waist slab of a stair case spanning longitudinally is calculated as :

(1) $25\,D\sqrt{1+\left(\frac{R}{T}\right)^2}$ (2) $25\,d\sqrt{1+\left(\frac{R}{T}\right)^2}$

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

---

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

(1) $Ka = \frac{1}{3}Kp$ (2) $Ka = 3\,Kp$ (3) $Ka = \frac{1}{9}Kp$ (4) $Ka = 9\,Kp$

---

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

(1) 2.0 (2) 2.5 (3) 1.5 (4) 1.0

---

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

(1) (0.12%) bT (2) (0.16%) bT (3) (0.20%) bT (4) (0.24%) bT

---

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

(1) Lateral loads due to wind (2) Lateral loads due to earthquake

(3) Vertical live load only (4) Vertical dead load and live loads

---

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

Where, q_0 = safe bearing capacity of soil

γ = Density of soil,

ϕ = Angle of repose

(1) $\frac{\gamma}{q_0}\left(\frac{1-\sin\phi}{1+\sin\phi}\right)^2$ (2) $\frac{q_0}{\gamma}\left(\frac{1-\sin\phi}{1+\sin\phi}\right)^2$

(3) $\frac{\gamma}{q_0}\left(\frac{1+\sin\phi}{1-\sin\phi}\right)^2$ (4) $\frac{q_0}{\gamma}\left(\frac{1+\sin\phi}{1-\sin\phi}\right)^2$

---

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

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

---

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

(1) $x_u = x_{u,\max}$ (2) $x_u < x_{u,\max}$

(3) $x_u > x_{u,\max}$ (4) none of the above

---

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

(1) $\frac{0.85}{f_y}$ (bd) (2) $\frac{0.87}{f_y}$ (bd) (3) 0.04 (bd) (4) 0.04 (bD)

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

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

Answer options :

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

---

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

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

---

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

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

---

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

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

---

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

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

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

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

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

(1) Prestressing tension members (2) Fully prestressing members

(3) Non-prestressing members (4) Partial prestressing members

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

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

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

(1) It combines high strength concrete with high strength steel in an active manner.

(2) High tension steel wires are used to transfer tensile stresses to concrete section.

(3) Prestressing the steel against the concrete to counter balance any tensile stress produced by dead load and live load.

(4) Load balancing concept enables the transformation of a flexure member into a member under direct stress.

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

(1) Gifford Udall System (2) Magnel Blaton System

(3) Hoyer System (4) P.S.C. Monowire System

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

(1) $\frac{P}{A} \mp \frac{Pe}{Z} \pm \frac{M}{Z}$ (2) $\frac{P}{A} \mp \frac{Pe}{A} \pm \frac{M}{Z}$

(3) $\frac{P}{Z} \mp \frac{Pe}{Z} \pm \frac{M}{Z}$ (4) $\frac{P}{A} \mp \frac{Pe}{A} \pm \frac{M}{A}$

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78. In simply supported prestressed concrete beams with uniformly distributed loads over its entire span.

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

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

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

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

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

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

---

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

(1) Agitation and strikes only (2) Epidemic of large proportion only

(3) (1) and (2) above (4) None of the above

---

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

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

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

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

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

---

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

(1) Water type extinguishers

(2) Foam type extinguishers

(3) Dry chemical powder extinguishers

(4) Nitrogen extinguishers

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82. Decrease or reduction in the value of an equipment or asset is called as :

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

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

(1) Ergonomics (2) Economics

(3) Ecology (4) Engineering science and Economics

84. Which are the major methods of quality control ?

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

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

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

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

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

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

(1) Elton Mayo (2) Taylor F.W.

(3) Henry Fayol (4) None of the above

88. Total float can be expressed as :

(a) latest start time - earliest start time

(b) latest finish time - earliest finish time

Answer options :

(1) Both (a) and (b) are false (2) (a) is true but (b) is false

(3) Both (a) and (b) are true (4) (a) is false but (b) is true

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89. What are the advantages of a good site layout or job layout ?

(1) Smooth and economical working of project.

(2) It reduces the completion time of project.

(3) Provides more safety on site.

(4) All the above.

---

90. A method proposes a systematic strategy for reducing the system of equations to the upper triangular form using the forward elimination approach and then for obtaining values of unknowns using the back substitution process. This process is used in _____.

(1) Gauss Elimination method (2) Gauss Seidel method

(3) Matrix Inversion method (4) Method of relaxation

---

91. The area under the polynomial for three equal intervals (h) calculated by Simpson's rule is _____.

(1) $\frac{h}{6}\{f(x_0)+4f(x_1)+2f(x_2)+f(x_3)\}$

(2) $\frac{h}{3}\{f(x_0)+4f(x_1)+2f(x_2)+f(x_3)\}$

(3) $\frac{h}{3}\{f(x_0)+4[f(x_1)+f(x_3)]+2f(x_2)\}$

(4) $\frac{h}{6}\{f(x_0)+4[f(x_1)+f(x_2)]+2f(x_3)\}$

---

92. Name the iterative method which falls under the category of Bracketing methods that start with two initial guesses that bracket the root and then systematically reduce the width of the bracket until the solution is reached.

(1) Newton Raphson method (2) Bisection method

(3) Secant method (4) Fixed point method

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93. The solution of the equations,

$20x+y-2z=17$

$3x+20y-z=-18$

$2x-3y+20z=25$

by Jacobi's iteration method is :

(1) 1, −1, 1 (2) −1, −1, −1

(3) 1, 1, 1 (4) −1, −1, 1

---

94. The value of $\int_0^6 \frac{dx}{1+x^2}$ by using Trapezoidal rule is :

(1) 1.4108 (2) 1.3108 (3) 1.8104 (4) 1.0418

---

95. The solution for simultaneous equations by Gauss elimination method for,

$2x+3y-z=5$

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

$2x-3y+2z=2$ is :

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

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

---

96. The real root of the equation :

$f(x)=x^3-x-1=0$ is :

(1) 1.26 (2) 1.25 (3) 1.24 (4) 1.23

---

97. What is the area of bending moment diagram of a simply supported beam subjected to triangular load of intensity 'W' kN/m at centre of span (L) and zero at both ends using Simpson's rule, assuming an equal interval of $\left(\frac{L}{2}\right)$?

(1) $\frac{WL^3}{8}$ (2) $\frac{WL^3}{12}$ (3) $\frac{WL^3}{16}$ (4) $\frac{WL^3}{18}$

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

x	7.47	7.48	7.49	7.50	7.51	7.52
$y=f(x)$	1.93	1.95	1.98	2.01	2.03	2.06

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

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

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

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

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

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

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

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परीक्षेचे नांव : महाराष्ट्र अभियांत्रिकी सेवा (स्थापत्य) (मुख्य) परीक्षा- २०१५ परीक्षेचा दिनांक : ९ व १० जानेवारी, २०१६
विषय : प्रश्नपत्रिका क्र.२ (स्थापत्य अभियांत्रिकी पेपर - I)

महाराष्ट्र लोकसेवा आयोगामार्फत घेण्यात आलेल्या महाराष्ट्र अभियांत्रिकी सेवा (स्थापत्य), (मुख्य) परीक्षा - २०१५ या स्पर्धा परीक्षेच्या प्रश्नपत्रिकेची उत्तरतालिका उमेदवारांच्या माहितीसाठी संकेतस्थळावर प्रसिध्द करण्यात आली होती. त्यासंदर्भात उमेदवारांनी अधिप्रमाणित (Authentic) स्पष्टीकरण / संदर्भ देऊन पाठविलेली लेखी निवेदने, तसेच तज्ज्ञांचे अभिप्राय विचारात घेऊन आयोगाने उत्तरतालिका सुधारित केली आहे. या उत्तरतालिकेतील उत्तरे अंतिम समजण्यात येतील. यासंदर्भात आलेली निवेदने विचारात घेतली जाणार नाहीत व त्याबाबत कोणताही पत्रव्यवहार केला जाणार नाही, याची कृपया नॉंद घ्यावी.

उत्तरतालिका - KEY

प्रश्न क्रमांक	उत्तरे			
	संच A	संच B	संच C	संच D
1	3	1	1	1
2	1	3	1	3
3	1	3	2	4
4	3	4	2	3
5	1	1	3	4
6	4	2	1	1
7	3	3	3	3
8	2	4	3	2
9	2	4	4	3
10	4	2	4	4
11	3	1	3	1
12	4	3	4	2
13	3	3	4	2
14	3	1	3	3
15	4	4	3	3
16	3	2	2	3
17	4	4	3	4
18	1	2	2	1
19	3	3	1	3
20	2	3	2	4
21	3	2	4	2
22	2	3	3	3
23	2	3	3	2
24	4	4	4	3
25	2	4	2	1

प्रश्न क्रमांक	उत्तरे			
	संच A	संच B	संच C	संच D
26	3	2	2	4
27	1	1	4	3
28	4	2	3	1
29	1	3	3	4
30	3	1	1	2
31	2	1	4	4
32	1	4	1	2
33	4	3	1	4
34	4	4	4	1
35	2	2	2	3
36	1	1	1	1
37	2	2	1	2
38	3	3	3	4
39	2	1	3	2
40	2	3	2	2
41	4	1	1	2
42	1	4	4	1
43	3	2	2	1
44	2	2	2	2
45	1	2	2	3
46	4	1	2	3
47	3	3	1	3
48	3	1	1	1
49	1	3	3	1
50	1	3	1	4

Date -3rd March, 2016

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प्रश्नपत्रिका क्र.२ (स्थापत्य अभियांत्रिकी पेपर - I)

प्रश्न क्रमांक	उत्तरे			
	संच A	संच B	संच C	संच D
51	1	1	1	1
52	2	2	3	**1**
53	**1**	**1**	4	2
54	3	4	2	1
55	1	2	3	3
56	2	1	1	2
57	2	1	4	2
58	1	2	2	2
59	3	3	4	3
60	2	2	2	1
61	3	2	1	2
62	4	4	3	4
63	2	1	3	4
64	1	4	2	2
65	2	3	2	3
66	4	2	1	2
67	2	2	2	1
68	**4**	4	1	4
69	1	**4**	4	4
70	4	**2**	2	1
71	2	3	1	3
72	1	1	**4**	2
73	4	1	2	1
74	**2**	2	1	1
75	2	4	**2**	1

प्रश्न क्रमांक	उत्तरे			
	संच A	संच B	संच C	संच D
76	3	1	4	**2**
77	1	1	1	2
78	1	2	3	**4**
79	3	4	4	4
80	2	2	1	4
81	4	2	3	2
82	2	3	2	1
83	1	3	2	2
84	4	2	3	3
85	3	3	3	3
86	2	3	4	3
87	3	4	2	2
88	3	1	4	3
89	4	4	3	4
90	1	1	2	1
91	**#**	3	1	4
92	2	1	**#**	4
93	1	1	4	1
94	1	**#**	4	1
95	3	3	3	3
96	2	1	3	2
97	4	2	1	**#**
98	3	2	1	1
99	1	4	2	3
100	4	4	1	2

Date -3rd March, 2016

ने दर्शविलेले प्रश्न रद्द करण्यात आलेले आहेत.

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महाराष्ट्र अभियांत्रिकी सेवा (स्थापत्य) (मुख्य) परीक्षा-2015
परीक्षा दिनांक - 9 व 10 जानेवारी, 2016

A

2016

CODE : CO7

प्रश्नपुस्तिका क्रमांक
BOOKLET NO.

प्रश्नपुस्तिका-III

वेळ : 2 (दोन) तास

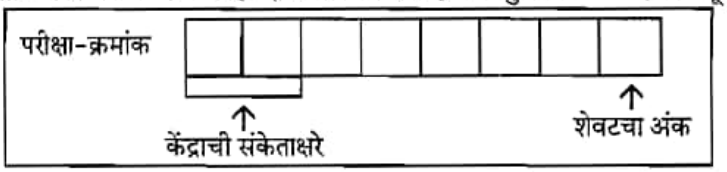
स्थापित्य अभियांत्रिकी पेपर-2

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. असा 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.

(7) **प्रस्तुत परीक्षेच्या उत्तरपत्रिकांचे मूल्यांकन करताना उमेदवाराच्या उत्तरपत्रिकेतील योग्य उत्तरांनाच गुण दिले जातील. तसेच ''उमेदवाराने वस्तुनिष्ठ बहुपर्यायी स्वरूपाच्या प्रश्नांची दिलेल्या चार पर्यायांपैकी 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.

पर्यवेक्षकांच्या सूचनेविना हे सील उघडू नये

SEAL

पुढील सूचना प्रश्नपुस्तिकेच्या अंतिम पृष्ठावर पहा

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1. The modern electronic Tacheometers are a combination of :

(a) An electronic theodolite

(b) An electronic data collector

(c) An Electric distance measurement

Answer options :

(1) (a) and (b) only (2) (b) and (c) only

(3) (a) and (c) only (4) All of the above

---

2. In chain surveying, perpendiculars to the chain line are set out by :

(1) a theodolite (2) a prismatic compass

(3) a clinometer (4) an optical square

---

3. Least count of a levelling staff is :

(1) 1 cm (2) 5 mm

(3) 1 mm (4) None of the above

---

4. The backsight reading on a B.M. = R.L. of 150 m was (−2.250 m). The erected staff reading on the top of workshop floor was 1.450 m. The R.L. of the top of workshop floor is :

(1) 154.300 m (2) 146.300 m (3) 150.800 m (4) 145.800 m

---

5. If 'n' is the number of sides of a traverse, while theodolite traversing the sum of the interior included angles should be :

(1) $(2n-4)\times 90°$ (2) $(2n+4)\times 90°$ (3) $(2n\pm 4)\times 90°$ (4) 360°

---

6. What will be the curvature correction for staff reading, in levelling for a distance of 1000 m. ?

(1) 0.0673 m (2) 0.0785 m (3) 78.50 m (4) 6.73 m

---

7. Spire test is carried out for the permanent adjustment of :

(1) Dumpy level (2) Auto level (3) Tilting level (4) None of these

---

8. The lines joining the points of equal elevations on the surface of the earth are known as :

(1) isohyets (2) isogonics (3) agonics (4) contours

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9. What is the magnetic declination at a place if the magnetic bearing of the sun at noon at that place is 186° ?

(1) 6° W (2) 6° E (3) 0° W (4) 0° E

10. The process of locating the instrument station occupied by plane table from stations whose positions have already been plotted on plan is known as :

(1) Orientation (2) Radiation (3) Intersection (4) Resection

11. Salvage value is defined as :

(1) value of dismantled materials of a property at the end of its utility period

(2) estimated value of a built up property at the end of its useful life without being dismantled

(3) value of the property shown in the account book in that particular year

(4) present value of a property considering it to be replaced at the current market rates

12. The rights and privileges which an owner of a property enjoys through or over the property of another is known as :

(1) Property right (2) Lease right (3) Legal right (4) Easement

13. For a contract to be valid :

(a) Parties to the contract should be competent

(b) Proper proposal and its acceptance

(c) Free consent of parties involved in the agreement

(d) Lawful consideration

Answer options :

(1) (a) and (c) (2) (c) only

(3) (a), (b) and (d) (4) All of the above

14. The unit of measurement for earthwork in surface excavation exceeding 1.5 m in width as well as 10 sqm on plan but not exceeding 30 cm in depth, is in :

(1) cu. m (2) sq. m (3) 10 sq.m (4) Rmt

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15. A tender is said to be informal :

(a) When it is not submitted in the form sold by the department

(b) When the tender is not properly filled in or signed by the contractor

(c) When the tender is made conditional by way of adding indefinite an l uncertain liabilities of usual character to it.

(d) When it is not supported by the requisite earnest money in the manner prescribed for the purpose in PWD form :

Answer options :

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

---

16. At what change of price level is a revised estimate prepared ?

(1) 2.0% (2) 2.5% (3) 4.0% (4) 5.0%

---

17. Which committee recommended that an allowance of 10% of the prime cost as the contractor's profit would be reasonable ?

(1) The Rates and Costs Committee, 1957 (2) MPWD Committee, 1940

(3) CPWD Committee, 1950 (4) MPSC Committee, 2010

---

18. The capitalised value of a property fetching a net annual rent of ₹ 1000 with highest rate of interest prevailing being 5%, would be :

(1) ₹ 800 (2) ₹ 1000 (3) ₹ 10,000 (4) ₹ 20,000

---

19. While submitting a tender, the contractor is required to deposit some amount with the department, as guarantee of the tender, known as :

(1) Bank Guarantee (2) EMD. (3) S.D. (4) F.D.

---

20. If the porosity of a soil sample is 40%, its void ratio is :

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

---

21. A cube of soil specimen having dimensions 2 cm × 2 cm × 2 cm weighs 16 gm when it is fully saturated. If void ratio of the specimen is 1.0, the dry density of the specimen will be :

(1) 2000 kg/m^3 (2) 1500 kg/m^3 (3) 1200 kg/m^3 (4) 1600 kg/m^3

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22. **Statement (A) :** In Boussinesq's theory of stress computations, soil is considered to be un-stressed before application of the load.

Statement (B) : The contact pressure distribution under a rigid footing in cohesionless soil, is uniform throughout the width of the footing.

(1) Both the statements **(A)** and **(B)** are correct.

(2) Statement **(A)** is correct but **(B)** is wrong.

(3) Statement **(A)** is wrong but **(B)** is correct.

(4) Both the statements **(A)** and **(B)** are wrong.

---

23. A sample of dry sand was tested in direct shear test apparatus under a normal load of 72 kg. The shear load required to fail the sample was found to be 36 kg. The angle of internal friction (ϕ) will be :

(1) $\tan^{-1}\left(\frac{72+36}{36}\right)$ (2) $\tan^{-1}\left(\frac{72+36}{72}\right)$

(3) $\tan^{-1}\left(\frac{36}{72}\right)$ (4) $\tan^{-1}\left(\frac{72}{36}\right)$

---

24. A point load exerts a maximum vertical stress at a radial distance of 1 m and at a depth of :

(1) 0.817 (2) 0.477 (3) 1.00 (4) 1.225

---

25. **Statement (A) :** Coffer-dam is a structure to be constructed in standing water condition prior to the construction of bridge foundations.

Statement (B) : Cutting edge and steining are the two essential component parts of the coffer-dam.

(1) Both the statements **(A)** and **(B)** are true.

(2) Both the statements **(A)** and **(B)** are false.

(3) Statement **(A)** is true but **(B)** is false.

(4) Statement **(B)** is true but **(A)** is false.

---

26. From the following statements, select the most appropriate statement :

Westergaard's analysis for stress computation within soil mass assumes.

(1) Point load at the surface and soil being homogeneous and isotropic

(2) Line load at the surface and soil being homogeneous and non-isotropic

(3) Point load at the surface and soil being homogeneous and non-isotropic

(4) Line load at the surface and soil being non-homogeneous and isotropic

---

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27. An all-around RCC peripheral retaining wall is constructed for a basement to retain soil on the other side. The retaining wall has RCC floor slab constructed at the top. The earth pressure on retaining wall will be analyzed in :

(1) Passive condition

(2) Active condition

(3) At rest condition

(4) Partially active and partially passive condition

---

28. Match the pairs :

(a)	Compaction	(i)	Expulsion of water
(b)	Swelling	(ii)	Sudden volume decrease
(c)	Consolidation	(iii)	Increase in volume
(d)	Collapse	(iv)	Expulsion of air

Answer options :

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

---

29. The specific speed of turbine is defined as :

(1) $\frac{H^{\frac{5}{4}}}{N\sqrt{P}}$ (2) $\frac{N P^{\frac{5}{4}}}{\sqrt{H}}$ (3) $\frac{N\sqrt{P}}{H^{\frac{5}{4}}}$ (4) $\frac{N^{\frac{5}{4}} P}{\sqrt{H}}$

---

30. Muschel curves belong to the category of :

(1) main characteristic curves of a turbine

(2) operating characteristic curves of a turbine

(3) constant efficiency curves of a turbine

(4) operating characteristics of a pump

---

31. Pathlines refer to the motion of identified fluid particles of elements and therefore constitute a feature of the :

(1) Lagrangian Approach (2) Eulerian Approach

(3) Rayleigh's Approach (4) None of the above

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32. The separation of a boundary layer occurs when :

(1) the flow is accelerated past a boundary

(2) the boundary layer comes to rest

(3) any adverse pressure is encountered

(4) the fluid is ideal

---

33. Choose the correct match :

(a)	Inertial force to surface tensile force	(i)	Reynold's No.
(b)	Inertial force to viscous force	(ii)	Euler No.
(c)	Inertial force to pressure force	(iii)	Mach No.
(d)	Inertial force to elastic force	(iv)	Weber No.
		(v)	Froude No.

Answer options :

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

---

34. The centre of pressure will coincide with the centre of gravity if a plane surface is :

(1) Vertical (2) Horizontal

(3) Immersed in a gas (4) None of the above

---

35. A horizontal pipe line conveys a constant rate of flow which is measured by venturimeter installed on it. When the pipe is inclined upwards in the direction of flow, the reading of level difference on a differential U-tube manometer :

(1) will increase (2) will remain same

(3) will decrease (4) may fluctuate with time

---

36. A surge tank is provided in hydropower schemes to :

(1) strengthen the penstocks

(2) reduce water hammer pressure

(3) reduce frictional losses in the system

(4) increase the net head

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37. If three pipes of different diameters, lengths and friction factors are connected in series, then :

(1) $f=f_1+f_2+f_3$ (2) $hf_1=hf_2=hf_3$

(3) $Q=Q_1+Q_2+Q_3$ (4) $Q_1=Q_2=Q_3$

38. The difference between theoretical discharge and actual discharge of pump is known as :

(1) gap of discharge (2) differential discharge

(3) slip of pump (4) suction gap

39. A unit speed is obtained by which of the following equations with usual notations ?

(1) $N_u=\frac{N}{\sqrt{H}}$ (2) $N_u=\frac{\sqrt{N}}{H}$ (3) $N_u=\frac{\sqrt{N}}{\sqrt{H}}$ (4) $N_u=\frac{N^{\frac{2}{3}}}{H^{\frac{1}{5}}}$

40. A turbine is a device which converts :

(1) Hydraulic energy into mechanical energy

(2) Mechanical energy into hydraulic energy

(3) Kinetic energy into mechanical energy

(4) Electrical energy into mechanical energy

41. Operating characteristic curves of a turbine are :

(1) Varying speed curves (2) Constant efficiency curves

(3) Constant head curves (4) Constant speed curves

42. Overall efficiency of a pump is obtained by which of the following equations with usual notations ?

(1) $\eta_0=\eta_{man}\times\eta_{mech}$ (2) $\eta_0=\eta_{hy}\times\eta_{mech}$

(3) $\eta_0=\eta_{man}\times\eta_{hy}$ (4) $\eta_0=\eta_{vol}\times\eta_{min}$

43. To produce a high head multi-stage centrifugal pumps, the impellers are connected :

(1) in parallel (2) in series

(3) in parallel and in series both (4) none of the above

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44. The specific speed(N_s) of a pump is given by :

(1) $N_s = \frac{N\sqrt{Q}}{H_m^{\frac{5}{4}}}$ (2) $N_s = \frac{N\sqrt{P}}{H_m^{\frac{3}{4}}}$ (3) $N_s = \frac{N\sqrt{Q}}{H_m^{\frac{3}{4}}}$ (4) $N_s = \frac{N\sqrt{P}}{H_m^{\frac{5}{4}}}$

45. Number of buckets on a Pelton wheel are calculated by which equation with usual notations :

(1) $Z = 15 + \frac{D}{2d}$ (2) $Z = 15 + \frac{2D}{d}$

(3) $Z = 15 + 2\left(\frac{D}{d}\right)n$ (4) $Z = 15 + \frac{d}{D}$

46. Which of the following statements is **correct** ?

(1) Pelton wheel is a reaction turbine

(2) Pelton wheel is a radial flow turbine

(3) Pelton wheel is an impulse turbine

(4) None of the above

47. When specific information about the density of snowfall is not available, the water equivalent of snowfall is taken as :

(1) 50% (2) 30% (3) 10% (4) 90%

48. The percentage of total quantity of fresh water in the world available in the liquid form is about :

(1) 30% (2) 70% (3) 11% (4) 51%

49. The precipitation in the form of water drops of sizes larger than 0.5 mm is known as :

(1) snow (2) drizzle (3) glaze (4) rainfall

50. The chemical that is found to be more suitable as water evaporation inhibitor is :

(1) ethyl alcohol (2) methyl alcohol (3) cetyl alcohol (4) bytyl alcohol

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51. In a DAD analysis the maximum average depth of rainfall for an 18 hr storm was 28 cm in an area of size 10 km^2. For the same duration the maximum average depth in an area of 1000 km^2 can be expected to be :

(1) = 28 cm (2) < 28 cm

(3) > 28 cm (4) depends upon the type of rainfall

---

52. The direct runoff is made up of :

(1) overland flow and infiltration

(2) surface runoff, prompt interflow and channel precipitation

(3) surface runoff, infiltration and evapotranspiration

(4) rainfall and evaporation

---

53. Precipitation falling during the growing period of a crop that is available to meet the evapo-transpiration needs of the crop is known as :

(1) effective rainfall (2) transpiration

(3) conjuctive use (4) potential rainfall

---

54. Evapotranspiration is confined to :

(1) daylight hours (2) night-time only

(3) land surfaces only (4) none of the above

---

55. The prismoidal formula with usual notations is :

(1) $\Delta S = \text{storage} = \frac{\Delta h}{5}[A_1 + 4A_2 + A_3 ...]$

(2) $\Delta S = \text{storage} = \frac{\Delta h}{6}[A_1 + 4A_2 + A_3 ...]$

(3) $\Delta S = \text{storage} = \frac{\Delta h}{3}[A_1 + 4A_2 + A_3 ...]$

(4) $\Delta S = \text{storage} = \frac{\Delta h}{6}[A_1 + 3A_2 + 4A_3 ...]$

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P.T.O.

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56. An aqueduct is a cross drainage work provided to carry canal over a natural drain when :

(1) canal bed is at the same level as the bed of the natural drain.

(2) canal bed is below the H.F.L. of the natural drain.

(3) canal bed is well above the H.F.L. of the natural drain.

(4) canal bed is below the bed of the natural drain.

---

57. Open flume outlet is :

(1) an orifice (2) a weir

(3) a meter (4) none of the above

---

58. In a saddle-siphon spillway, an air vent is provided at the level of the full reservoir surface to :

(1) break the siphonic action at that level

(2) initiate the siphonic action at that level

(3) prevent cavitation

(4) maintain ventilation inside the siphon

---

59. _____ is aligned along a watershed and runs for most of its length on a watershed.

(1) Ridge canal (2) Contour canal

(3) Side slope canal (4) None of the above

---

60. As per IS 10430-1982, the life of canal for concrete lining is assumed to be :

(1) 40 years (2) 60 years (3) 80 years (4) 99 years

---

61. _____ maintain a deep channel in front of the head regulator and dispose of heavy silt and a part of flood discharge on the down stream side of the barrage.

(1) Radial gates (2) Spillway (3) Stilling basin (4) Under sluice

---

62. In a syphon aqueduct, severe condition of maximum uplift on the floor occurs when :

(1) canal runs full, drain is dry but water table is at the stream bed.

(2) canal is dry and drain is passing the highest flood.

(3) canal runs dry and drain also runs dry.

(4) both canal and drain run full.

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63. In _____ the overflowing water is guided smoothly over the crest and profile of the spillway.

(1) Straight drop Spillway (2) Ogee Spillway

(3) Tunnel Spillway (4) Siphon Spillway

64. The ratio of rate of change of discharge of an outlet to the rate of change of the discharge of the distribution channel is known as _____.

(1) Flexibility (2) Setting (3) Sensitivity (4) Efficiency

65. Match the pairs for determination of thickness of flexible pavement by appropriate method.

(a) California Bearing Ratio Method (i) $T = \frac{K(TI)(90-R)}{C^{\frac{1}{5}}}$

(b) California Resistance Valve Method (ii) $T = K \log_{10}^{\frac{P}{S}}$

(c) Triaxial Method (iii) $T = \left[\frac{1.75P}{CBR} - \frac{A}{\pi}\right]^{\frac{1}{2}}$

(d) McLeod Method (iv) $T = \sqrt{\left(\frac{3PXY}{2\pi E_s \Delta}\right)^2 - a^2}$

Answer options :

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

66. The maximum width of expansion joint and maximum spacing between expansion joint for rough interface layer is :

(1) 2.5 cm and 160 m (2) 2.0 cm and 130 m

(3) 2.5 cm and 140 m (4) 2.5 cm and 100 m

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67. The total length of tie bar of 1 cm diameter embedded in a cement concrete pavement with allowable working stress in steel in tension equal to 1400 kg/cm^2 and allowable bond stress in deformed bars in concrete 24.6 kg/cm^2, is :

(1) 18.87 cm (2) 113.82 cm (3) 56.9 cm (4) 28.45 cm

68. The tests performed for detecting whether bitumen is cracked or not, is/are :

(a) Spot test (b) Solubility test

(c) Float test (d) Ductility test

Select the **correct** alternative out of the following :

(1) (a) only (2) (a) and (b) only

(3) (a), (c) and (d) only (4) (b) and (d) only

69. The dowel bars are provided at :

(1) Expansion joint

(2) Contraction joint

(3) Both (1) and (2)

(4) Both (1) and (2) and Longitudinal joint

70. Failures in flexible pavements are due to the failure of :

(a) Sub grade

(b) Base course

(c) Wearing Course

Answer options :

(1) (a) and (b) only (2) (a) and (c) only

(3) (b) and (c) only (4) (a), (b) and (c)

71. Bitumen grade is specified as 80-100 or $\frac{80}{100}$ grade, this means :

(1) Bitumen content is between 80 to 100.

(2) Ductility of bitumen is between 80 to 100 mm.

(3) Penetration value of bitumen is between 80 to 100.

(4) Temperature of the bitumen is between 80 to 100°C

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72. The critical condition of stresses for combination of stresses in cement concrete pavement during summer is :

(1) load stress + warping stress − frictional stress

(2) load stress + warping stress

(3) load stress + warping stress + frictional stress

(4) load stress + frictional stress

---

73. Arrange the following layers of flexible pavement from top to bottom :

(a) Sub-base course (b) Base course

(c) Surface course (d) Sub-grade

Answer option :

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

(3) (c), (a), (b), (d) (4) (c), (b), (a), (d)

---

74. A culvert can be defined as a crossing with a total length not exceeding _____ between the faces of the abutments :

(1) 6 m (2) 7 m (3) 8 m (4) 10 m

---

75. What should be the minimum width of foot path while designing a bridge for rural areas ?

(1) 1.5 m (2) 2.0 m (3) 2.5 m (4) 3.0 m

---

76. Maximum scour depth at a severe bend is :

(1) 1.25 D (2) 1.50 D (3) 1.75 D (4) 2.00 D

---

77. _____ can be defined as a rise of water level on the upstream side of a bridge.

(1) Scour (2) Afflux (3) HFL (4) Discharge

---

78. The area through which the water flows under a bridge superstructure is known as _____ of the bridge.

(1) stream (2) scour (3) waterway (4) afflux

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79. The type of bearing used on a bridge depends on :
(1) Extent of movement at the bridge ends
(2) Temperature Variations
(3) Load carried
(4) All of the above

80. The minimum vertical clearance for opening of high level bridges for discharge of 0.3-3.0 m^3 per second is :
(1) 150 mm (2) 250 mm (3) 350 mm (4) 450 mm

81. A bridge designed to allow normal floods to pass through its vents but allowed to be over topped during floods is called :
(1) Submersible bridge (2) Under bridge
(3) Seasonal bridge (4) None of the above

82. Advantages of asphaltic concrete (Bituminous Concrete) are :
(a) Durability (b) Imperviousness
(c) Load spreading properly (d) Quickly openable to traffic
(e) Good skid Resistance
Answer options :
(1) (a) and (b) only. (2) (a), (b) and (c) only.
(3) (a), (b), (c) and (d) only. (4) All of the above.

83. Pick up the explosive used for tunnelling in soft rocks from the following :
(1) Special gelatine (2) Blasting gelatine
(3) Ammonia dynamite (4) Semi-gelatine

84. Which one of the following tunnelling methods is used for laying under ground sewers ?
(1) Needle beam method (2) German method
(3) Army method (4) English method

85. To attain the required shape of the tunnel we use :
(1) Cutholes (2) Chisels (3) Easers (4) Trimmers

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86. For initial surveys of tunnel, the following activities are involved :

(a) Marking portal points with concrete pillars on the ground.

(b) Marking tunnel obligatory points on the topographical maps.

(c) Driving lines between the fixed obligatory points.

(d) Preliminary setting of the tunnel on the topographical survey of Indian maps.

The correct sequence of the activities are :

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

---

87. If 'D' is a diameter of tunnel in meters, then the thickness of lining in mm as per the empirical formula is given by :

(1) 72 D (2) 82 D (3) 92 D (4) 102 D

---

88. The concentration of dust particles of the size 0.5 to 5 microns adjacent to the working face should not be more than :

(1) 450 particles/cm^3 (2) 350 particles/cm^3

(3) 250 particles/cm^3 (4) 150 particles/cm^3

---

89. For highways, tunnelling is preferred if the open cut exceeds :

(1) 10 m depth (2) 15 m depth (3) 20 m depth (4) 25 m depth

---

90. In compressed air tunnelling the volume of free air provided is :

(1) 10 cuft per seconds per sq.ft. of face area

(2) 10 m^3 per min. per m^2 of face area

(3) 20 cuft per min. per sq.ft. of face area

(4) 6 m^3 per hour per m^2 of face area

---

91. The length of the needle beam used in the needle beam method of tunnelling is usually :

(1) 2 m to 4 m (2) 1.5 m to 4.5 m (3) 6 m to 7 m (4) 5 m to 6 m

---

92. Indian municipal solid waste is not suitable for incineration due to :

(1) less moisture content (2) high moisture content

(3) high calorific value (4) Lesser organic content

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93. In waste water treatment plant secondary settling tanks are designed to remove :

(1) Organic settleable solids (2) Inorganic settleable solids

(3) Bioflocculated solids (4) Dissolved solids

94. During inversion condition :

(1) Air temperature decreases with altitude

(2) Air temperature increases with altitude

(3) Air temperature remains constant

(4) Air temperature is zero

95. As per Central Pollution Control Board (CPCB) Air Quality Index for satisfactory condition is in the range of :

(1) 301 to 400 (2) 201 to 300 (3) 101 to 200 (4) 51 to 100

96. When is a photo chemical smog formed ?

(1) Air stagnation

(2) High concentrations of hydrocarbon and nitrogen

(3) Both (1) and (2)

(4) None of these

97. For taking sewer line below road/canal/railway line, following type of sewer *appartenances* should be provided.

(1) Storm water relief work (2) Siphon spillways

(3) Jumping weir (4) Inverted syphon

98. Permanent hardness is removed by :

(a) Lime soda process

(b) Boiling

(c) Demineralisation process

(d) Base exchange process

Answer options :

(1) (a) only (2) (b) only

(3) All of the above (4) (a), (c) and (d) only

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99. As per CPCB, ambient Air Quality Standards in respect of noise during day time and night time for residential area are :

(1) 75 dB and 70 dB respectively (2) 65 dB and 55 dB respectively

(3) 55 dB and 45 dB respectively (4) 50 dB and 40 dB respectively

---

100. What is the food to micro-organism ratio in an aeration tank having following data ?

Flow = 1 m/d, MLSS = 2000 mg/L

Influent BOD_5 = 200 mg/L

Volume of aeration tank = 500 m^3

(1) 0.20 (2) 5.00 (3) 0.80 (4) 1.25

- o 0 o -

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परीक्षेचे नांव : महाराष्ट्र अभियांत्रिकी सेवा (स्थापत्य) (मुख्य) परीक्षा- २०१५ परीक्षेचा दिनांक : ९ व १० जानेवारी, २०१६
विषय : प्रश्नपत्रिका क्र. ३ (स्थापत्य अभियांत्रिकी पेपर - II)

महाराष्ट्र लोकसेवा आयोगामार्फत घेण्यात आलेल्या महाराष्ट्र अभियांत्रिकी सेवा (स्थापत्य)(मुख्य) परीक्षा - २०१५ या स्पर्धा परीक्षेच्या प्रश्नपत्रिकेची उत्तरतालिका उमेदवारांच्या माहितीसाठी संकेतस्थळावर प्रसिध्द करण्यात आली होती. त्यासंदर्भात उमेदवारांनी अधिप्रमाणित (Authentic) स्पष्टीकरण / संदर्भ देऊन पाठविलेली लेखी निवेदने, तसेच तज्ज्ञांचे अभिप्राय विचारात घेऊन आयोगाने उत्तरतालिका सुधारित केली आहे. या उत्तरतालिकेतील उत्तरे अंतिम समजण्यात येतील. यासंदर्भात आलेली निवेदने विचारात घेतली जाणार नाहीत व त्याबाबत कोणताही पत्रव्यवहार केला जाणार नाही, याची कृपया नोंद घ्यावी.

उत्तरतालिका - KEY

प्रश्न क्रमांक	उत्तरे			
	संच A	संच B	संच C	संच D
1	#	4	4	2
2	4	2	4	4
3	2	4	#	4
4	2	2	2	#
5	1	1	2	1
6	2	4	1	1
7	4	1	2	4
8	4	4	4	4
9	1	#	4	2
10	4	2	1	2
11	2	4	2	2
12	4	4	2	1
13	4	2	4	2
14	2	1	2	4
15	2	4	2	4
16	4	4	4	4
17	1	2	4	2
18	4	2	4	2
19	2	2	1	4
20	1	4	4	4
21	2	3	4	2
22	2	3	2	1
23	3	1	3	3
24	4	2	2	3
25	3	3	3	3

प्रश्न क्रमांक	उत्तरे			
	संच A	संच B	संच C	संच D
26	3	2	1	4
27	3	4	3	2
28	4	3	3	3
29	3	2	2	4
30	3	3	4	1
31	1	2	3	2
32	2	4	4	3
33	4	4	1	4
34	2	3	2	3
35	2	2	2	2
36	2	2	2	2
37	4	1	3	2
38	3	4	3	3
39	1	2	3	3
40	1	3	3	1
41	4	3	1	1
42	2	3	1	4
43	2	1	2	2
44	3	1	1	2
45	1	1	4	1
46	3	2	2	3
47	3	1	1	1
48	1	4	2	3
49	4	3	3	4
50	3	2	1	2

Date -3rd March, 2016

ने दर्शविलेले प्रश्न रद्द करण्यात आलेले आहेत.

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प्रश्न क्रमांक	उत्तरे			
	संच A	संच B	संच C	संच D
51	2	3	2	4
52	2	2	4	1
53	1	4	3	2
54	4	1	2	2
55	2	2	4	3
56	3	2	4	1
57	2	2	1	1
58	1	2	2	2
59	1	1	2	3
60	2	3	3	1
61	4	2	1	2
62	2	4	1	4
63	2	1	2	2
64	1	1	2	2
65	4	3	4	3
66	3	4	3	3
67	4	4	4	4
68	2	4	3	4
69	3	3	3	4
70	4	2	4	2
71	3	3	2	3
72	1	1	4	1
73	4	4	1	4
74	#	3	2	4
75	1	#	3	3

प्रश्न क्रमांक	उत्तरे			
	संच A	संच B	संच C	संच D
76	3	4	3	#
77	2	1	#	4
78	3	1	1	4
79	4	2	4	2
80	4	4	1	1
81	1	4	4	1
82	4	3	4	3
83	3	4	4	**3**
84	3	**3**	3	4
85	4	3	3	2
86	3	2	3	1
87	2	1	3	4
88	1	3	2	3
89	**3**	3	4	3
90	3	4	1	3
91	4	3	**3**	3
92	2	2	4	3
93	3	1	3	1
94	2	3	2	2
95	4	4	2	4
96	3	3	4	4
97	4	4	1	2
98	4	2	3	4
99	3	3	4	3
100	1	4	3	3

Date – 3rd March, 2016

ने दर्शविलेले प्रश्न रद्द करण्यात आलेले आहेत.

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महाराष्ट्र अभियांत्रिकी सेवा (स्थापत्य) (मुख्य) प-2017

प्रश्नपुस्तिका क्रमांक दि 17 डिसेंबर 2017
BOOKLET No.

103941

प्रश्नपुस्तिका-I

संच क्र. **A**

Q10 **स्थापत्य अभियांत्रिकी पेपर – 1**

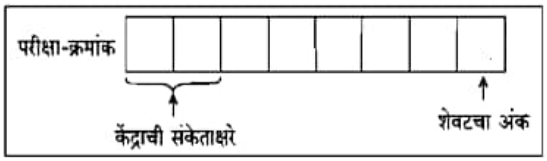
वेळ : 2 (दोन) तास

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. असा 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 सूचनेशिवाय हे सील उघडू नये

SEAL SE

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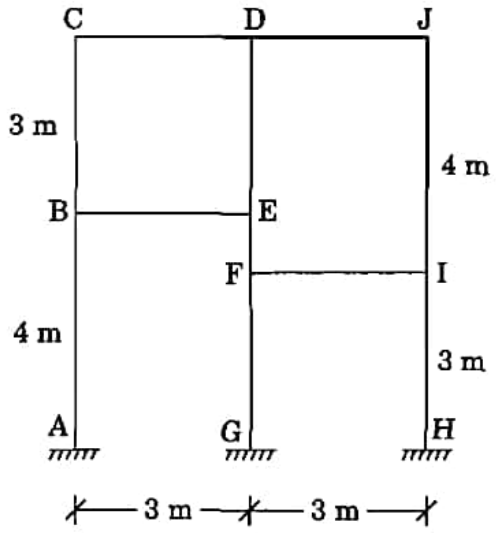
1. Determine the degree of static and kinematic indeterminacy of the frame structure as shown in the figure.

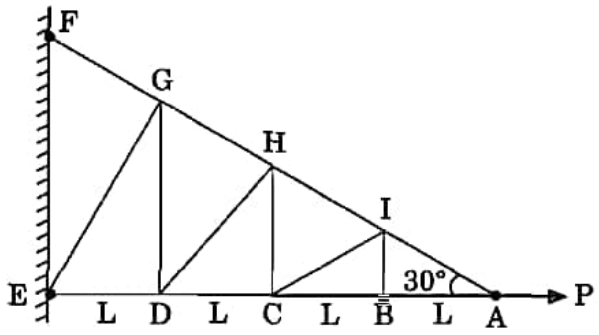


(1) 15, 8 (2) 12, 12

(3) 12, 10 (4) 15, 9

---

2. A cantilever truss as shown in the figure is subjected to a horizontal load 'P' at joint A. The total number of zero force members in the truss is



(1) 6 (2) 4

(3) 9 (4) 10

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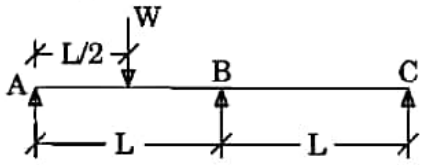
3. A continuous beam ABC is as shown in the figure. End supports are simple (i.e., A and C) and span AB = span BC = L. There is a concentrated load 'W' at the centre of the span AB while no load over the span BC. E_j is same for both the spans. What is the moment at the continuous support B ?



(1) $-\frac{WL^3}{16}$

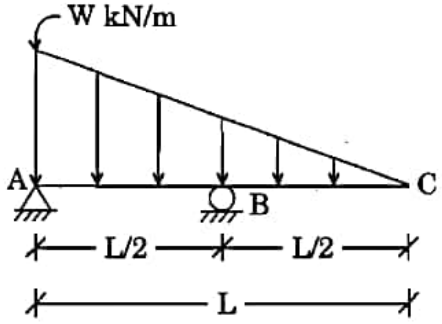
(2) $-\frac{WL^2}{32}$

(3) $-\frac{3WL^2}{32}$

(4) $-\frac{3WL^2}{16}$

---

4. A beam ABC is supported and loaded as shown in the figure. Find the support reactions at A and B. (Neglect horizontal reaction at A)



(1) $\frac{WL}{3}, \frac{WL}{3}$

(2) $\frac{WL}{3}, \frac{WL}{6}$

(3) $\frac{WL}{6}, \frac{WL}{3}$

(4) $\frac{WL}{6}, \frac{WL}{6}$

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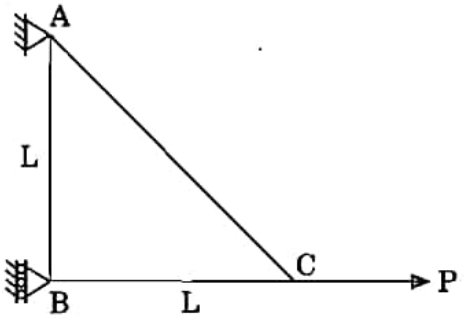
5. A simple truss ABC is supported at A and B as shown in the figure. If a point load (P) along BC is applied at joint C in horizontal direction, then what will be the vertical deflection at C ? Assume same C/5 area and same materials (i.e., A, E, I same for all members).



(1) $\frac{PL}{AE}$ (↑)

(2) $\frac{2PL}{AE}$ (↓)

(3) $\frac{PL}{AE}$ (↓)

(4) $\frac{2PL}{3AE}$ (↓)

---

6. In a fixed beam of span 'L' subjected to a central concentrated load 'W', the fixed end moment and moment at midspan are respectively

(1) $\frac{WL}{12}$ and $\frac{WL}{6}$

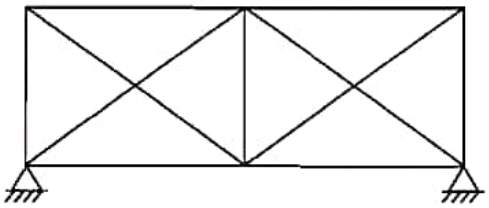
(2) $\frac{WL}{8}$ and $\frac{WL}{8}$

(3) $\frac{WL}{6}$ and $\frac{WL}{12}$

(4) None of the above

---

7. In the pin-jointed truss shown in the figure, the static degree of indeterminacy is



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

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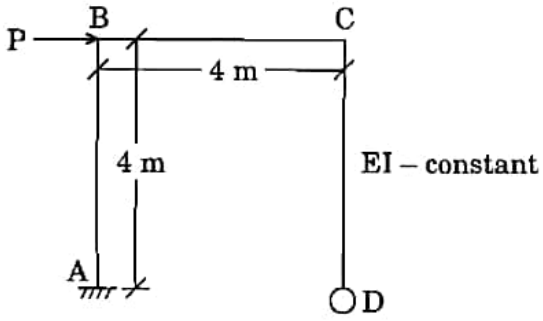
8. For the frame shown in the figure, the shear equation is



(1) $\frac{M_{BA} + M_{AB}}{4} + \frac{M_{CD}}{4} + P = 0$

(2) $\frac{M_{AB} + M_{BC}}{4} + \frac{M_{DC}}{4} + P = 0$

(3) $M_{AB} + M_{BA} + M_{CD} + M_{DC} = 0$

(4) $M_{AB} + M_{BA} + M_{CD} + M_{DC} = P$

---

9. In the force method of analysis of indeterminate trusses, if the truss is indeterminate to degree one, the change in length of redundant member due to unit force is found by using the formula

where A is cross-sectional area

I – Moment of Inertia

n – force in the member due to unit load application

N – force in the member due to actual load

E – Modulus of Elasticity

(1) $\sum \frac{n\,NL}{EI}$ (2) $n \sum \frac{NL}{AE}$

(3) $\sum \frac{n\,NL}{AE}$ (4) $\sum \frac{NL}{AE}$

---

10. In the moment distribution method, the carry over moment is equal to

(1) double of its corresponding distributed moment and has same sign

(2) one-half of its corresponding distributed moment and has same sign

(3) one-half of its corresponding distributed moment and has opposite sign

(4) None of the above

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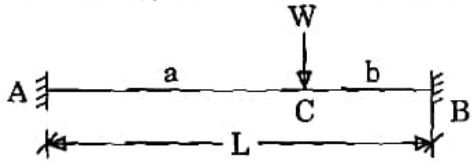
11. For both ends of the fixed beam shown in the figure carrying a concentrated load eccentrically placed on the beam, deflection under load is



(1) $-\frac{W a^2 b^2}{3 EIL^2}$ (2) $-\frac{W ab^2}{3 EIL}$

(3) $-\frac{W a^3 b^3}{3 EIL^3}$ (4) $-\frac{W a^3 b^2}{3 EIL^2}$

12. A continuous beam ABC is simply supported at supports A, B and C. Portion AB has span of 6 m and BC 4 m. Portion AB is loaded with a concentrated load of 120 kN downward at 3 m from A. The qualitative reactions shall be

(1) Reactions at A and B shall be upward and reaction at C shall be zero

(2) Reactions at A and B shall be upward and reaction at C shall be downward

(3) All reactions i.e., at A, B and C shall be upwards

(4) None of the above

13. A beam AB is simply supported and has flexural rigidity EI. The flexural strain energy of the beam having span 6 m and carrying a central point load of 10 kN is

(1) 142·38/EI (2) 775/EI

(3) 225/EI (4) None of the above

14. A given determinate truss is loaded with gravity loads. Under these loads different nodes undergo deflection horizontally and vertically. Thereafter the truss is subjected to a temperature drop of 50°C in the lower chord only. The coefficient of expansion or contraction $\alpha = 11{\cdot}7 \times 10^{-6}/°C$. Which of the following statements is true ?

(1) Vertical and horizontal deflection along lower chord nodes remains the same.

(2) Vertical and horizontal deflections along lower chord nodes shall change.

(3) Horizontal deflection along lower chord nodes shall change but vertical deflection shall not change

(4) None of the above

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15. If the span and dip of a parabolic cable are L and h respectively, then the length of the cable is approximately equal to

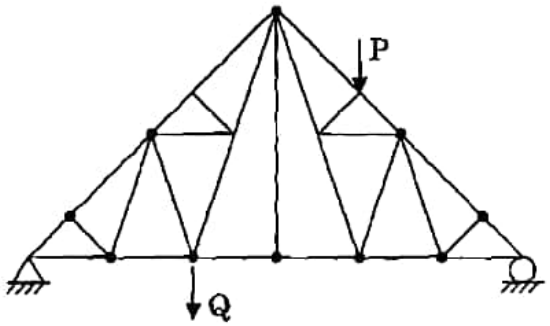
(1) $L + 3/8\ h$ (2) $L + 8/3\ h$

(3) $L + 3/8\ h^2/L$ (4) $L + 8/3\ h^2/L$

16. A three-hinged semicircular arch of radius R carries a uniformly distributed load W per unit run over the whole span.
The horizontal thrust is

(1) R (2) $\frac{WR}{2}$ (3) $\frac{4}{3\pi}WR$ (4) $\frac{2}{3\pi}WR$

17. For the plane truss shown in the figure, the number of zero force members for the given loading is



(1) 4 (2) 8 (3) 11 (4) 13

18. A structure is said to be statically indeterminate when

(1) the number of unknown reaction components exceeds the number of equilibrium conditions.

(2) the number of equilibrium conditions exceeds the number of unknown reaction components.

(3) the number of equilibrium conditions equal to the number of unknown reaction components.

(4) None of the above

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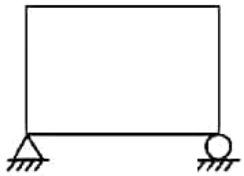
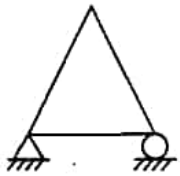
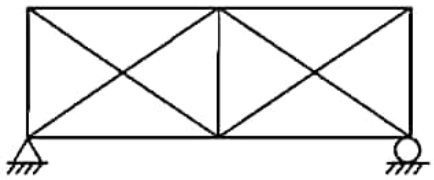
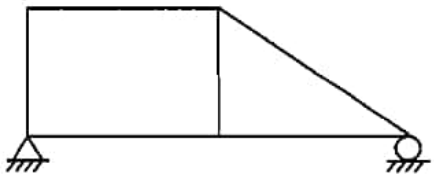
19. Which truss is the perfect truss out of the following ?

(1) 

(2) 

(3) 

(4) 

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20. The flexibility method is also known as the

(1) Energy method (2) Equilibrium method

(3) Displacement method (4) Force method

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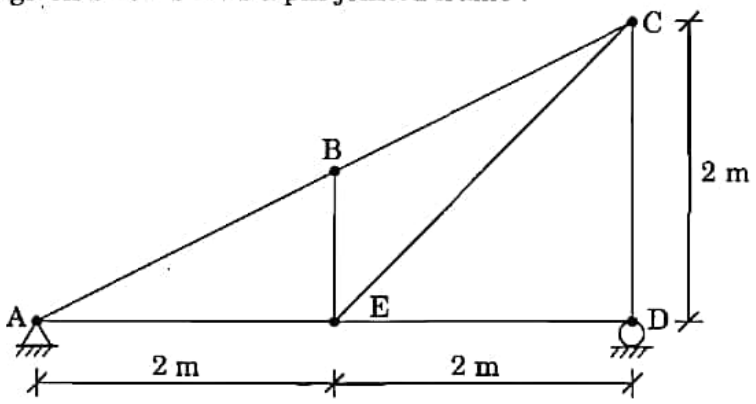
21. The figure given below shows a pin-jointed frame :



What are the forces in members BE, CD and ED ?

(1) 10 kN, 5 kN and 5 kN (2) 10 kN, 5 kN and Zero

(3) 5 kN, 10 kN and Zero (4) 5 kN, 5 kN and Zero

---

22. A beam ABC is simply supported at A and B, BC is overhanging. Span AB = 8 m, BC = 2 m. Point 'D' is situated at 3 m from A. Using an influence line diagram or otherwise, find the maximum ordinates at 'D' of the influence line diagram for shear at 'D'.

(1) – 0·375 (2) – 0·625 (3) + 0·625 (4) + 1·875

---

23. For compression members with double angle section, unequal angles are preferred to equal angles because

(1) they are easy for connection

(2) they lead to large value of minimum radius of gyration

(3) they have lesser effective length

(4) of saving in gusset plate material

---

24. Minimum pitch for riveted connections should ***not*** be less than

(1) 1·5 times the hole diameter

(2) 2·5 times the hole diameter

(3) 1·5 times the nominal diameter of rivet

(4) 2·5 times the nominal diameter of rivet

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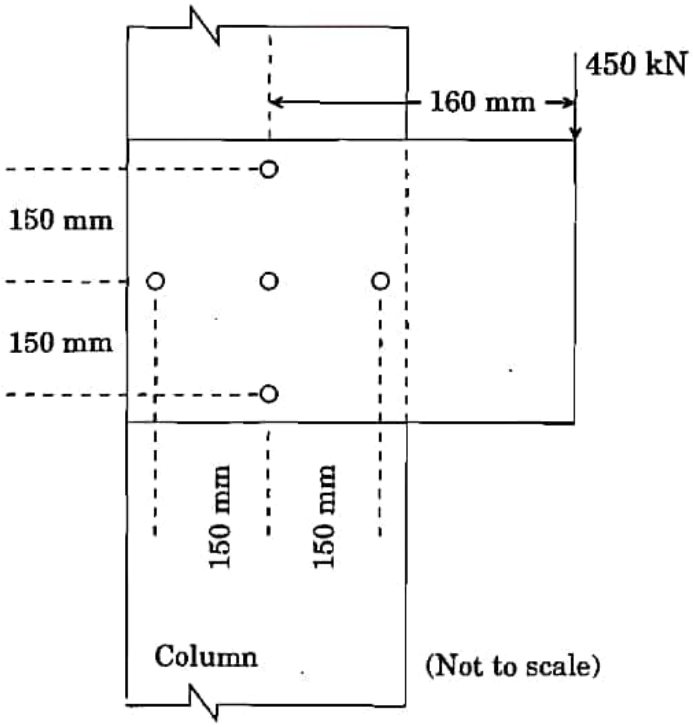
25. The effective slenderness ratio of a battened column, λ_e, is taken as 1·10 times the actual slenderness ratio of the column to account for

(1) Axial deformation (2) Bending deformation

(3) Shear deformation (4) All of the above

---

26. The maximum design force for a rivet in the following bracket connection, if spacing between adjacent rivets is 150 mm, is



(1) 150 kN (2) 175 kN

(3) 200 kN (4) 212·5 kN

---

27. The minimum thickness of a base plate, t_s in case of slab base can be calculated by the formula

(1) $t_s = \sqrt{2{\cdot}5w(b^2 - 0{\cdot}3a^2) f_y / \gamma_{m_0}}$ (2) $t_s = \sqrt{2{\cdot}5\, w(b^2 - 0{\cdot}3b^2)\gamma_{m_0} / f_y}$

(3) $t_s = \sqrt{2{\cdot}5\, w(a^2 - 0{\cdot}3b^2)\gamma_{m_0} / f_y}$ (4) $t_s = \sqrt{2{\cdot}5w(a^2 - 0{\cdot}3b^2) f_y / \gamma_{m_0}}$

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

(1) Zero
(2) $0{\cdot}4\ kN/m^2$
(3) $0{\cdot}75\ kN/m^2$
(4) $0{\cdot}55\ kN/m^2$

29. If a structure is under fatigue stresses, then the welded joints as compared to riveted joints will fail

(1) Earlier
(2) Later
(3) At the same time
(4) Not at all

30. According to IS 800 : 2007, allowable vertical deflection for gantry girder with crane load (electronically operated up to 50 tons) is

(1) $\frac{span}{500}$
(2) $\frac{span}{750}$
(3) $\frac{span}{1000}$
(4) $\frac{span}{300}$

31. The design bending strength of a laterally supported beam is given by $M_d = (\beta_b.Z_p.f_y)/\gamma_{m_0}$, where β_b, Z_p, f_y and γ_{m_0} have their usual meaning. β_b for plastic and compact sections are given by

(1) 1·0, 0·8
(2) 0·8, 1·0
(3) 1, Z_e/Z_p
(4) 1, 1

32. The deep structural members subjected to transverse loads are called

(1) Beams
(2) Columns
(3) Plate girders
(4) Trusses

33. The optimum thickness of web, t_w, of a plate girder is given by

(1) $t_w = \left(\frac{M_z}{f_y.k^2}\right)^{0\cdot33}$
(2) $t_w = \left(\frac{f_y.k^2}{M_z}\right)^{0\cdot33}$
(3) $t_w = \left(\frac{M_z}{f_y.k^2}\right)$
(4) $t_w = \left(\frac{f_y.k^2}{M_z}\right)$

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34. In a singly reinforced balanced section, if M 30 concrete and Fe 415 steel is used, then the value of neutral axis factor (ku_{max}) in L.S.M. is

(1) 0·42 (2) 0·46

(3) 0·48 (4) 0·52

35. The maximum area of tension steel in a beam shall ***not*** exceed

(1) 0·15 bD (2) 0·12 bD

(3) 0·04 bD (4) 1·00 bD

36. Effective flange width of a continuous T-beam is

(1) $b_f = \frac{l_0}{6} + b_w + 6\,D_f$ (2) $b_f = \frac{l_0}{12} + b_w + 3\,D_f$

(3) $b_f = \frac{l_0}{\frac{l_0}{b} + 4} + b_w$ (4) $b_f = \frac{0{\cdot}5\,l_0}{\frac{l_0}{6} + 4} + b_w$

37. The maximum spacing of shear reinforcement measured along the axis of the member shall ***not*** exceed _____ for the vertical stirrups, where 'd' is the effective depth of the section.

(1) 0·5 d (2) 0·7 d

(3) 0·75 d (4) 0·65 d

38. Determine the minimum and maximum longitudinal reinforcement for a square column of size 300 mm × 300 mm having a clear cover of 25 mm.

(1) 500 mm^2 and 3750 mm^2

(2) 500 mm^2 and 5400 mm^2

(3) 720 mm^2 and 3750 mm^2

(4) 720 mm^2 and 5400 mm^2

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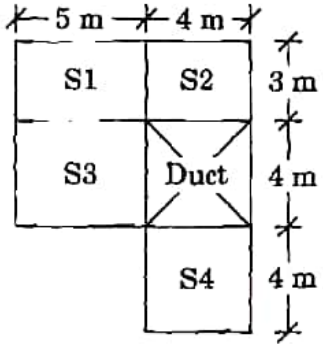
39. Match the end conditions for restrained slab panels :



a.	S1	I.	Four edges continuous
b.	S2	II.	One long edge continuous
c.	S3	III.	Two adjacent edges discontinuous
d.	S4	IV.	Four edges discontinuous
		V.	One short edge continuous

Select the correct response.

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

40. For a simply supported beam of span 12 m, the basic value of span to effective depth ratio is

(1) 20 (2) 26 (3) 65/3 (4) 50/3

41. Match the conditions under which the given type of footing is used :

a.	Combined footing	I.	For two or more columns
b.	Mat foundation	II.	For isolated or group of columns
c.	Pile foundation	III.	For individual column
d.	Isolated footing	IV.	For supporting all columns of structure

Select the correct response.

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

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42. The height of a retaining wall is 5·5 m. It is to be designed as

(1) Cantilever type (2) Counterfort type

(3) Cantilever or counterfort type (4) None of the above

43. A shear key is provided in a retaining wall to avoid

(1) Sliding (2) Overturning

(3) Buckling (4) Bending

44. The imposed floor load acting on staircase for residential and educational buildings is to be considered as

(1) 2·0 kN/m^2 and 3·0 kN/m^2 (2) 3·0 kN/m^2 and 2·0 kN/m^2

(3) 4·0 kN/m^2 and 3·0 kN/m^2 (4) 3·0 kN/m^2 and 4·0 kN/m^2

45. The extreme stress at the top and bottom edges of a prestressed beam when tendons are placed along the longitudinal axis of the beam are

(1) $\frac{P}{A} \pm \frac{M}{Z}$ (2) $\frac{P}{Z} \pm \frac{M}{A}$

(3) $\frac{P}{A} \pm \frac{M}{I}$ (4) $\frac{P}{I} \pm \frac{M}{A}$

46. A simply supported rectangular prestressed concrete beam is subjected to uniformly distributed live load over its entire span, such that the resulting stress at the midspan at bottom fiber is zero. The eccentricity at that section is d/6 below the C.G., where d is the depth of the beam. Location of the thrust line at that section is

(1) At C.G. (2) d/6 above C.G.

(3) d/6 below C.G. (4) d/3 below C.G.

47. A 4·8 m long post-tensioned prestressed concrete beam is prestressed by a parabolic cable with eccentricity of 15 mm above C.G. at both supports and 45 mm below C.G. at the midspan. The beam is tensioned from one end. In the estimation of maximum loss due to friction, what should be the cumulative angle turned by the parabolic profile ?

(1) 0·01 radians (2) 0·1 radians

(3) 0·15 radians (4) 0·02 radians

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48. In a pre-tensioned prestressed concrete cross-section,

Statement 1 :

The stress in wires is assumed to be zero at the end supports and increases to its final maximum value over its transmission length.

Statement 2 :

The bond stress between concrete and prestressed wires is maximum near the end supports and decreases to nearly zero over its transmission length.

(1) Statements 1 and 2 are true

(2) Statement 1 is true and statement 2 is false

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

(4) Statements 1 and 2 are false

---

49. To avoid sudden collapse just after a shear crack, minimum shear reinforcement is provided in prestressed concrete member in the form of stirrups. IS 1343 suggested the relation as

(1) $\frac{A_{sv}}{b \, . \, s_v} = \frac{0{\cdot}4 \, d}{0{\cdot}87 \, f_y}$

(2) $\frac{A_{sv}}{bd \, . \, s_v} = \frac{0{\cdot}4}{0{\cdot}87} \times f_y$

(3) $\frac{A_{sv}}{b \, . \, s_v} = \frac{0{\cdot}4}{0{\cdot}87 \, f_y}$

(4) $\frac{A_{sv}}{b \, . \, s_v} = \frac{0{\cdot}4 \, f_{ck}}{0{\cdot}87 \, f_y}$

---

50. What is the maximum possible eccentricity in a prestressed concrete beam of circular cross-section ? Diameter of the section is d. Tension is not allowed anywhere and any time in the cross-section. Neglect dead load (self-weight).

(1) d/8 (2) d/6

(3) d/4 (4) d/3

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51. What will be the maximum possible uniformly distributed load (inclusive of self-weight) over the entire span of a simply supported beam of span 'L' such that the deflection at midspan at service condition is zero ? The cross-section is rectangular. The prestressing force 'P' is applied with uniform eccentricity 'e'. Assume no losses.

(1) $\frac{8Pe}{L^2}$ (2) $\frac{8{\cdot}8Pe}{L^2}$

(3) $\frac{9{\cdot}6Pe}{L^2}$ (4) $\frac{10{\cdot}4Pe}{L^2}$

---

52. The loss due to creep in prestressed concrete shall be determined considering

(1) All loads and prestressing force

(2) Live loads and prestressing force

(3) Permanent loads and prestressing force

(4) Permanent loads only

---

53. The limit state of collapse for prestressed concrete is

(1) Limit state of collapse : Deflection

(2) Limit state of collapse : Cracking

(3) Limit state of collapse : Maximum compression

(4) None of the above

---

54. The designed prestressed concrete element should satisfy the limits specified for permissible stresses at transfer stage as well as service condition. The prestressing force 'P' and eccentricity 'e' evaluated from those limits are

(1) Maximum value of 'P' and maximum value of 'e'

(2) Maximum value of 'P' and minimum value of 'e'

(3) Minimum value of 'P' and maximum value of 'e'

(4) Minimum value of 'P' and minimum value of 'e'

---

55. During tensioning of prestressing tendons the breakage of wires in any one prestressed concrete member shall ***not*** exceed

(1) 2·5% (2) 7·5% (3) 10% (4) 12·5%

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56. Who is known as the Father of Scientific Management ?

(1) Robert Owen

(2) Elton Mayo

(3) F.W. Taylor

(4) Henry Fayol

---

57. ABC analysis is referred to as

(1) Always Better Control analysis

(2) Alphabetical Backup Control analysis

(3) Analytical Boost Crane analysis

(4) None of the above

---

58. A scaled drawing of the proposed construction site showing all the relevant features such as entry and exit points to the site, storage area for materials, toilets, workers quarters, etc. is called

(1) Construction Plan

(2) Job Layout

(3) Development Plan

(4) Architectural Plan

---

59. The event or events that immediately come before another event without any intervening events are called _____ events to that event.

(1) Successor

(2) Dummy

(3) Predecessor

(4) Slack

---

60. Which rule is used for numbering the events in a network, scientifically ?

(1) Stevenson's rule

(2) Jackson's rule

(3) Fulkerson's rule

(4) Watson's rule

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61. The cost inflow a firm receives if a machine still has value at the time of its disposal is known as

(1) Salvage value
(2) Purchase expenses
(3) Operating cost
(4) Ownership cost

62. Williams-Steiger Occupational Safety and Health Act (OSH Act) was passed in the year

(1) 1968 (2) 1970
(3) 1974 (4) 1972

63. Coefficient of traction for a crawler tractor is upto

(1) 0·9 (2) 0·6
(3) 1·2 (4) 1·0

64. Which of the following is a "Class-A" item in ABC analysis ?

(1) Items with low cost but large in number
(2) Items with average cost but moderate in number
(3) Items with high cost but few in number
(4) Items with high cost but large in number

65. Which of the following best defines "Negative Stock" ?

(1) Project ahead of schedule
(2) Project on schedule
(3) Project behind schedule
(4) None of the above

66. Quality circles in the construction industry can have the following participants :

(1) Engineers and architects
(2) Contractors and raw material suppliers
(3) Clients and consultants
(4) All of the above

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67. After solving the system

$$2x_1 + 4x_2 - 6x_3 = -8,$$

$$x_1 + 3x_2 + x_3 = 10, \text{ and}$$

$$2x_1 - 4x_2 - 2x_3 = -12$$

using Gauss-Jordan method, the values of x_1, x_2 and x_3 are

(1) (1, 2, 3) (2) (1, 3, 2)

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

---

68. The solution of the equations

$$5x_1 + x_2 + x_3 + x_4 = 4$$

$$x_1 + 7x_2 + x_3 + x_4 = 12$$

$$x_1 + x_2 + 6x_3 + x_4 = -5$$

$$x_1 + x_2 + x_3 + 4x_4 = -6$$

by Gauss-Jordan method is

(1) $-1, -2, 1, 2$ (2) $-1, -2, -1, 2$

(3) $-1, 2, -1, 2$ (4) $1, 2, -1, -2$

---

69. To find the root of $f(x) = 0$ by using the bisection method, an iteration is begun with the lower and upper guesses of the root. If x_{lower} and x_{upper} are the roots, then at the end of the iteration, the absolute relative approximate error in the estimated value of the root would be

(1) $\left|\frac{x_{upper}}{x_{upper} + x_{lower}}\right|$ (2) $\left|\frac{x_{lower}}{x_{upper} + x_{lower}}\right|$

(3) $\left|\frac{x_{upper} - x_{lower}}{x_{upper} + x_{lower}}\right|$ (4) $\left|\frac{x_{upper} + x_{lower}}{x_{upper} - x_{lower}}\right|$

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70. With initial approximation of $x_1 = x_2 = x_3 = 0$, what is the next value of x_1 in the following set of simultaneous equations ?

$$27x_1 + 6x_2 - x_3 = 81$$

$$6x_1 + 15x_2 + 2x_3 = 75$$

$$x_1 + x_2 + 50x_3 = 110$$

(1) 2·25 (2) 3·0

(3) 3·25 (4) 4·0

71. Match the following :

a.	Newton-Raphson method	I.	f(x) is a linear function of 'x'
b.	Simpson's 1/3rd rule	II.	The number of intervals must be even
c.	Trapezoidal rule	III.	Diagonal matrix
d.	Gauss Elimination	IV.	Solution of algebraic and transcendental equations
e.	Gauss-Jordan method	V.	Forward elimination and Backward substitution

Select the correct response.

	a	b	c	d	e
(1)	I	II	III	IV	V
(2)	II	III	I	V	IV
(3)	III	I	II	V	IV
(4)	IV	II	I	V	III

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72. The procedure adopted in the Gauss-Jordan method in solving linear simultaneous equations is

(1) It is required to assume initial approximate values of the variables.

(2) It reduces the given system of equations to a diagonal matrix.

(3) It reduces the given system of equations to an equivalent triangular system.

(4) The given matrix is factored into lower and upper triangular matrices.

---

73. The solution by Gauss-Jordan method for the following equations

$x + y + z = 9$

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

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

is

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

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

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

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

---

74. The Newton-Raphson method is said to have

(1) Linear convergence

(2) Superlinear convergence

(3) Quadratic convergence

(4) Oscillatory convergence

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75. Back substitution is required in the following method(s) in the solution of linear simultaneous equations :

(1) Gauss-Elimination method

(2) Gauss-Jordan method

(3) Iterative method

(4) All of the above

---

76. The following data is given for the velocity of a body as a function of time. It is required to find the velocity at t = 21 sec. For the purpose a quadratic polynomial $v(t) = at^2 + bt + c$ is to be used. The velocity profile is given as

t in sec	0	13	14	15	18	20	22	24
v(t) in m/s	0	225	248·5	316·6	517·35	535·35	570	589·5

The correct set of equations that will find a, b and c is

(1) $\begin{bmatrix} 169 & 13 & 1 \\ 225 & 15 & 1 \\ 324 & 18 & 1 \end{bmatrix} \begin{bmatrix} a \\ b \\ c \end{bmatrix} = \begin{bmatrix} 248·5 \\ 316·6 \\ 517·35 \end{bmatrix}$

(2) $\begin{bmatrix} 176 & 14 & 1 \\ 225 & 15 & 1 \\ 400 & 20 & 1 \end{bmatrix} \begin{bmatrix} a \\ b \\ c \end{bmatrix} = \begin{bmatrix} 248·5 \\ 316·6 \\ 535·35 \end{bmatrix}$

(3) $\begin{bmatrix} 169 & 13 & 1 \\ 196 & 14 & 1 \\ 225 & 15 & 1 \end{bmatrix} \begin{bmatrix} a \\ b \\ c \end{bmatrix} = \begin{bmatrix} 225 \\ 248·5 \\ 316·6 \end{bmatrix}$

(4) $\begin{bmatrix} 324 & 18 & 1 \\ 484 & 22 & 1 \\ 225 & 15 & 1 \end{bmatrix} \begin{bmatrix} a \\ b \\ c \end{bmatrix} = \begin{bmatrix} 517·35 \\ 589·50 \\ 316·6 \end{bmatrix}$

---

77. During the determination of roots of equations $x^2 + 2xy = 6$ and $x^2 - y^2 = 3$ using the Newton-Raphson method, the value of Jacobian matrix 'D' is found to be

(1) – 4

(2) – 8

(3) – 12

(4) + 4

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78. What is the minimum crushing strength of Granite used in India ?

(1) 200 N/mm^2 (2) 100 N/mm^2

(3) 50 N/mm^2 (4) 250 N/mm^2

79. Which of the following is ***not*** a test for measuring the workability of concrete ?

(1) Slump Test (2) Flow Test

(3) Le Chatelier's Test (4) Compaction Factor Test

80. Which of the following is a field test for measuring the consistency of plastic concrete ?

(1) Le Chatelier's Test (2) Compaction Factor Test

(3) Elongation Index Test (4) Kelly Ball Test

81. In which type of bond is cavity existing ?

(1) Flemish bond (2) English bond

(3) Rat-trap bond (4) Stretcher bond

82. Which of the following is a method of mechanical ventilation ?

(1) Plenum System (2) Bleeding System

(3) Segregation System (4) Natural Ventilation System

83. Gypsum is added to Portland cement during its manufacturing so that it may

(1) Accelerate the setting time

(2) Retard the setting time

(3) Decrease the burning temperature

(4) Facilitate grinding

84. Principles of planning for buildings include

a. Aspect and Prospect b. Roominess

c. Grouping d. Flexibility and Privacy

Answer options :

(1) a and b only (2) b and d only

(3) a and c only (4) a, b, c and d

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85. Timber can be made reasonably fire-resistant by

(1) Soaking it in Ammoniam Sulphate

(2) Coating it with Tar paint

(3) Pumping creosote oil into timber under high pressure

(4) Seasoning process

86. Which of the following is ***not*** a non-destructive test ?

(1) Rebound Hammer Test

(2) Surface Hardness Test

(3) Ultrasonic Pulse Velocity Test

(4) Soundness Test

87. Which is the major constituent of ordinary Portland cement ?

(1) CaO (2) MgO (3) SO_3 (4) Fe_2O_3

88. Which is an example of cased cast-in-situ concrete pile ?

(1) Raymond pile (2) Watson pile

(3) Reynold pile (4) Boston pile

89. As per building bye-laws, for fixing up the height of a building, which rule is generally used ?

(1) $63\frac{1}{2}°$ Rule (2) $37\frac{2}{3}°$ Rule

(3) $65\frac{1}{2}°$ Rule (4) 45° Rule

90. The stress developed due to external force in an elastic material

(1) Depends on elastic constant

(2) Does not depend on elastic constant

(3) Depends partially on elastic constant

(4) Depends on limit of proportionality

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91. The Modulus of Elasticity in terms of Bulk Modulus and Modulus of Rigidity is

(1) $\frac{9KG}{3K+G}$ (2) $\frac{9KG}{K+3G}$ (3) $\frac{3K+G}{9KG}$ (4) $\frac{K+3G}{9KG}$

---

92. In case of biaxial stresses, the maximum value of shear stress is

(1) Difference of normal stresses

(2) Half the difference of normal stresses

(3) Sum of normal stresses

(4) Half the sum of normal stresses

---

93. If a solid circular shaft is simultaneously subjected to a torque 'T' and a bending moment 'M', the ratio of maximum bending stress and maximum torsional shearing stress is given by

(1) M/T (2) T/M

(3) 2M/T (4) 2T/M

---

94. The slenderness ratio of a vertical column of square cross-section of 2·5 cm sides and 300 cm effective length, is

(1) 200 (2) 360

(3) 240 (4) 416

---

95. Columns of given length, cross-section and material have different values of buckling loads for different end conditions. The strongest column is one whose

(1) one end is fixed and the other end is hinged

(2) both the ends are hinged or pin-jointed

(3) one end is fixed and the other entirely free

(4) both the ends are fixed

---

96. A circular shaft was initially subjected to bending moment and then was subjected to torsion. If the magnitude of bending moment is found to be the same as that of the torque, then the ratio of maximum bending stress to shear stress would be

(1) 0·25 (2) 0·50

(3) 2·0 (4) 4·0

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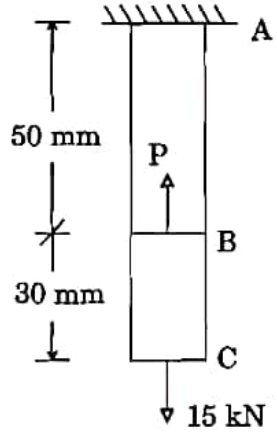
97. A steel bar ABC of uniform cross-section 100 mm^2 is suspended vertically and loaded as shown in the figure. If the lower end of bar C does not move when loads are applied (neglect self-weight), then the value of force P is (E_s = 200 kN/mm^2)



(1) 24 kN (2) 42 kN (3) 36 kN (4) 15 kN

---

98. Principal stresses at a point in a plane stressed element are $\sigma_x = \sigma_y$ = 500 N/mm^2. Normal stress on the plane inclined at 45° to the x-axis will be

(1) Zero (2) 500 N/mm^2

(3) 1000 N/mm^2 (4) 707 N/mm^2

---

99. The Euler's crippling load for a 2 m long slender steel rod of uniform cross-section hinged at both the ends is 1 kN. The Euler's crippling load for a 1 m long steel rod of the same cross-section and hinged at both the ends will be

(1) 0·25 kN (2) 0·5 kN

(3) 2 kN (4) 4 kN

---

100. A solid shaft of diameter 'D' carries a twisting moment that develops maximum shear stress. If the shaft is replaced by a hollow one of outside diameter 'D' and inside diameter $\frac{'D'}{2}$, then the maximum shear stress will be

(1) 1·067 τ (2) 1·143 τ

(3) 1·33 τ (4) 2 τ

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परीक्षेचे नांव : महाराष्ट्र **अभियांत्रिकी सेवा (स्थापत्य) (मुख्य) परीक्षा- 2017** **परीक्षेचा दिनांक : 17 डिसेंबर, 2017**
विषय : प्रश्नपत्रिका क्र.1 **(स्थापत्य अभियांत्रिकी पेपर - I)**

महाराष्ट्र लोकसेवा आयोगातर्फे घेण्यात आलेल्या **महाराष्ट्र अभियांत्रिकी सेवा (स्थापत्य) (मुख्य) परीक्षा- 2017** या स्पर्धा परीक्षेच्या प्रश्नपत्रिकेची उत्तरतालिका उमेदवारांच्या माहितीसाठी संकेतस्थळावर प्रसिध्द करण्यात आली होती. त्यासंदर्भात उमेदवारांनी अधिप्रमाणित (Authentic) स्पष्टीकरण / संदर्भ देऊन पाठविलेली लेखी निवेदने, तसेच तज्ज्ञांचे अभिप्राय विचारात घेऊन आयोगाने उत्तरतालिका सुधारित केली आहे. या उत्तरतालिकेतील उत्तरे अंतिम समजण्यात येतील. यासंदर्भात आलेली निवेदने विचारात घेतली जाणार नाहीत व त्याबाबत कोणताही पत्रव्यवहार केला जाणार नाही, याची कृपया नोंद घ्यावी.

उत्तरतालिका - KEY

प्रश्न क्रमांक	उत्तरे			
	संच A	संच B	संच C	संच D
1	3	3	3	1
2	4	3	1	4
3	#	1	2	3
4	3	3	3	2
5	1	4	3	4
6	2	3	1	2
7	3	4	2	2
8	1	2	1	3
9	3	1	**3**	1
10	2	1	3	3
11	3	4	4	3
12	2	1	1	2
13	3	2	4	3
14	2	2	3	4
15	4	1	2	3
16	2	3	4	1
17	2	1	2	2
18	1	3	2	4
19	2	3	3	**1**
20	4	4	1	4
21	#	3	3	1
22	3	1	3	1
23	2	3	2	1
24	4	1	3	2
25	3	2	4	1

प्रश्न क्रमांक	उत्तरे			
	संच A	संच B	संच C	संच D
26	1	3	3	2
27	3	3	1	3
28	4	1	2	4
29	**2**	2	4	4
30	2	1	**1**	3
31	4	**3**	4	1
32	3	3	1	2
33	1	4	1	4
34	3	1	1	1
35	3	4	2	3
36	1	3	1	4
37	3	2	2	#
38	4	4	3	3
39	3	2	4	1
40	4	2	4	2
41	2	3	3	3
42	1	1	1	1
43	1	3	2	3
44	4	3	4	2
45	1	2	1	3
46	2	3	3	2
47	2	4	4	3
48	1	3	#	2
49	3	1	3	4
50	1	2	1	2

Date : 28th March, 2018

 # ने दर्शविलेले प्रश्न रद्द करण्यात आलेले आहेत.

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प्रश्नपत्रिका क्र.१ (स्थापत्य अभियांत्रिकी पेपर - I)

प्रश्न क्रमांक	उत्तरे			
	संच A	संच B	संच C	संच D
51	3	4	2	2
52	3	1	3	1
53	4	4	1	2
54	3	1	3	4
55	1	1	2	#
56	3	1	3	3
57	1	2	2	2
58	2	1	3	4
59	3	2	2	3
60	3	3	4	1
61	1	4	2	3
62	2	4	2	4
63	1	3	1	2
64	3	1	2	2
65	3	2	4	4
66	4	4	#	3
67	1	1	3	1
68	4	3	2	3
69	3	4	4	3
70	2	#	3	1
71	4	3	1	3
72	2	1	3	4
73	2	2	4	3
74	3	3	2	4
75	1	1	2	2

प्रश्न क्रमांक	उत्तरे			
	संच A	संच B	संच C	संच D
76	3	3	4	1
77	3	2	3	1
78	2	3	1	4
79	3	2	3	1
80	4	3	3	2
81	3	2	1	2
82	1	4	3	1
83	2	2	4	3
84	4	2	3	1
85	1	1	4	3
86	4	2	2	3
87	1	4	1	4
88	1	#	1	3
89	1	3	4	1
90	2	2	1	3
91	1	4	2	1
92	2	3	2	2
93	3	1	1	3
94	4	3	3	3
95	4	4	1	1
96	3	2	3	2
97	1	2	3	1
98	2	4	4	3
99	4	3	3	3
100	1	1	1	4

Date : 28th March, 2018

ने दर्शविलेले प्रश्न रद्द करण्यात आलेले आहेत.

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महाराष्ट्र अभियांत्रिकी सेवा (स्थापत्य) (मुख्य) प-2017

प्रश्नपुस्तिका क्रमांक दि 17 डिसेंबर, 2017

BOOKLET No. 203937

प्रश्नपुस्तिका-II

संच क्र. **A**

R10

स्थापत्य अभियांत्रिकी पेपर – 2

वेळ : 2 (दोन) तास

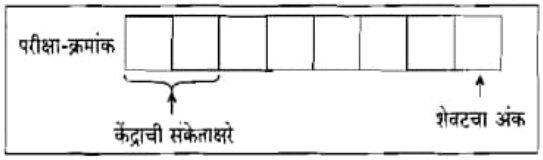
एकूण प्रश्न : 100

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. असा 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".**

पर्यवेक्षकांच्या सूचनेविना हे सील उघडू नये

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

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1. The dimensions of dynamic viscosity are

(1) L^2/T (2) M/LT

(3) MT/L (4) T/L^2

2. If the velocity potential function $\phi = 5 (x^2 - y^2)$, the velocity components at the points (4, 5) will be

(1) $u = -35, v = 40$

(2) $u = -40, v = 55$

(3) $u = -40, v = 50$

(4) $u = 40, v = -50$

3. Printer's ink is an example of

(1) Newtonian fluid

(2) Non-Newtonian fluid

(3) Thixotropic substance

(4) Elastic solid

4. Dynamic Viscosity of a gas

(1) Increases as temperature decreases

(2) Increases as temperature increases

(3) Is independent of temperature

(4) May increase or decrease with increase in temperature, depending on the nature of gas

5. According to Froude's model law

(1) $\frac{V_p \times L_p}{\nu_p} = \frac{V_m \times L_m}{\nu_m}$ (2) $\frac{V_m}{\sqrt{g_m L_m}} = \frac{V_p}{\sqrt{g_p L_p}}$

(3) $\frac{V_m}{\sqrt{p_m}} = \frac{V_p}{\sqrt{p_p}}$ (4) $\frac{V_m}{\sqrt{\sigma_m / \rho_m L_m}} = \frac{V_p}{\sqrt{\sigma_p / \rho_p L_p}}$

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6. For a hydrostatic pressure measurement in fluids at rest,

(1) The shear stress depends upon the coefficient of viscosity

(2) The shear stress is maximum on a plane inclined 45° to horizontal

(3) The shear stress is zero

(4) The shear stress is zero only on horizontal plane

---

7. If in a flow field $\frac{p}{\gamma} + \frac{v^2}{2g} + z$ = constant between any two points, flow must be

(1) Steady, compressible and irrotational

(2) Unsteady, incompressible and irrotational

(3) Steady, incompressible and irrotational

(4) Steady, compressible and along a stream line

---

8. For a centrifugal pump, suction lift head is the

(1) Vertical distance between the top surface of liquid level in the discharge tank and pump centre line

(2) Vertical distance between free surface of liquid level in the sump and pump centre line

(3) Head for overcoming friction loss in the suction pipe, entry loss at entrance to the friction pipe and running fluid in the suction pipe

(4) None of the above

---

9. The centre of buoyancy of a submerged body

(1) Coincides with the centre of gravity of the body

(2) Coincides with the centroid of the displaced volume of the fluid

(3) Is always below the centre of gravity of the body

(4) Is always above the centroid of the displaced volume of the liquid

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कच्च्या कामासाठी जागा / SPACE FOR ROUGH WORK

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10. What is the range of the speed ratio for a Francis Turbine ?

(1) 0·10 to 0·30 (2) 0·60 to 0·90

(3) 0·85 to 0·90 (4) 1·40 to 2·25

11. For high head, the suitable turbine is

(1) Pelton (2) Francis

(3) Kaplan (4) None of the above

12. The discharge through a single-acting reciprocating pump is

(1) $Q = \frac{ALN}{60}$ (2) $Q = \frac{2\,ALN}{60}$

(3) $Q = ALN$ (4) $Q = 2\,ALN$

13. The specific speed (N_s) of a pump is given by the expression

(1) $N_s = \frac{N\sqrt{Q}}{H_m^{5/4}}$ (2) $N_s = \frac{N\sqrt{P}}{H_m^{3/4}}$

(3) $N_s = \frac{N\sqrt{Q}}{H_m^{3/4}}$ (4) $N_s = \frac{N\sqrt{P}}{H_m^{5/4}}$

14. Jet ratio (m) is defined as the ratio of

(1) Diameter of the jet of water to diameter of the Pelton wheel

(2) Velocity of vane to velocity of the jet of water

(3) Velocity of flow to velocity of the jet of water

(4) Diameter of Pelton wheel to diameter of the jet of water

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15. A graph between the pressure head in the cylinder and the distance travelled by the piston from inner dead centre for one complete revolution of crank in known as

(1) Slip diagram

(2) Crank diagram

(3) Polar diagram

(4) Indicator diagram

---

16. A turbine is called impulse if at the inlet of the turbine

(1) Total energy is only kinetic energy

(2) Total energy is only pressure energy

(3) Total energy is the sum of kinetic energy and pressure energy

(4) None of the above

---

17. Which of the following statements is correct ?

(1) Curves at constant speed are called main characteristics curves.

(2) Curves at constant head are called main characteristic curves.

(3) Curves at constant efficiency are called operating characteristic curves.

(4) Curves at constant efficiency are called main characteristic curves.

---

18. The manometer head (H_m) of a centrifugal pump is given by

(1) Pressure head at outlet of pump – pressure head at inlet

(2) Total head at inlet – total head at outlet

(3) Total head at outlet – total head at inlet

(4) None of the above

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19. The Goodrich method is used for
(1) Determining reservoir capacity
(2) Flood routing
(3) Reservoir sediment evaluation
(4) Trap efficiency

20. The extent by which the inflow hydrograph gets modified due to the reservoir storage can be computed by a process known as
(1) River routing
(2) Channel routing
(3) S hydrograph
(4) Flood routing or reservoir routing

21. A permeable stratum which is capable of yielding appreciable quantities of groundwater under gravity is known a/an
(1) Well
(2) Artesian well
(3) Aquifer
(4) Aquiclude

22. In routing a flood through a reach, the point of intersection of inflow and outflow hydrographs coincides with the peak of outflow hydrograph
(1) In all cases of flood routing
(2) In channel routing only
(3) In all cases of reservoir routing
(4) When the inflow is into a reservoir with an uncontrolled outlet

23. The volume of groundwater extracted by gravity drainage from a saturated water bearing material is known as
(1) Field capacity
(2) Specific retention
(3) Specific capacity
(4) Yield

24. The distance from the centre of a pumped well to the point, where the drawdown is zero or is inappreciable, is known as
(1) Drawdown
(2) Cone of pressure
(3) Radius of influence
(4) Piezometric surface

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25. The well yield per unit drawdown is known as

(1) Specific capacity of a well (2) Efficiency of a well

(3) Retention of a well (4) Well loss

26. If within a zone of saturation, an impervious deposit below a pervious deposit is found to support a body of saturated material, then this body of saturated material is known as

(1) Flowing well (2) Aquiclude

(3) Artesian aquifer (4) Perched aquifer

27. If S_y = Specific yield and S_r = Specific retention, then

(1) $S_y + S_r = 0{\cdot}50$ (2) $S_y + S_r$ = Porosity

(3) $S_y + S_r = 1{\cdot}0$ (4) $S_y + S_r$ = Permeability

28. _____ is an example of a non-rigid dam.

(1) Arch dam (2) Timber dam

(3) Steel dam (4) Rockfill dam

29. 'Bank storage' in a dam reservoir

(1) Decreases the computed reservoir capacity

(2) Increases the computed reservoir capacity

(3) Sometimes decreases and sometimes increases the computed reservoir capacity

(4) Has no effect on reservoir capacity

30. In case of gravity dams, the factor of safety against over turning should not be less than

(1) 1·00 (2) 1·10 (3) 1·25 (4) 1·50

31. Sharper crest of an ogee spillway

(1) Increases the value of coefficient of discharge

(2) Decreases the effective head

(3) Increases stability of crest due to hydrostatic pressure

(4) Has no effect on any one of the above

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32. A land is known as waterlogged when
(1) Gravity drainage has ceased
(2) Permanent wilting point is reached
(3) The soil becomes completely saturated
(4) Capillary fringe reaches the root zone of the plants

33. Seepage failure of earth-filled dam is due to
(1) Toe erosion (2) Wave erosion
(3) Gullying (4) Sloughing

34. Auxiliary devices in stilling basins are provided
(1) To stabilise the flow
(2) To reduce the length of the basin
(3) As additional measure to control jump
(4) All of the above

35. Which of the following structures is constructed to separate under sluices from the main weir ?
(1) Marginal bund (2) Divide wall
(3) Head regulator (4) None of the above

36. The crest of an emergency spillway is placed
(1) Below the designed minimum reservoir water level
(2) At the designed minimum reservoir water level
(3) At or above the designed minimum reservoir water level
(4) None of the above

37. The road length of National Highway by Third Road Plan Formulae, in a certain district in India having its area as 13,400 sq.m will be
(1) 134 km (2) 268 km (3) 402 km (4) 1340 km

38. For the purpose of measuring the stopping sight distance, IRC had suggested the height of eye level of driver and the height of the object above the road surface as
(1) 1·5 m and 0·15 m (2) 1·2 m and 0·12 m
(3) 1·2 m and 0·15 m (4) 1·5 m and 0·12 m

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39. A vertical summit curve is formed at the intersection of two gradients, + 5% and – 5%. The length of summit curve needed to provide a stopping sight distance of 100 m will be

(1) 227 m (2) 0 m (3) 327 m (4) 197 m

40. The maximum utility system is based on the concept of

(1) Maximum utility per unit cost of road
(2) Maximum utility per unit length of road
(3) Maximum utility per unit population
(4) None of the above

41. Match the following :

a.	Primary survey	I.	Collect general characteristics of an area
b.	Map study	II.	Improvement in horizontal and vertical alignments
c.	Realignment of highway	III.	Collect physical information
d.	Reconnaissance	IV.	Alignment avoiding valleys, ponds or lakes

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

42. Determine the safe stopping sight distance for design speed of 14 m/s for two-way traffic on a two lane road assuming the coefficient of friction as 0·28 and a reaction time of 2 seconds.

(1) 63·67 m (2) 61·47 m (3) 53·27 m (4) 73·57 m

43. As per the modified classification of road system by the Third Road Development Plan, 1981 – 2001, the roads in the country under 'Primary System' of road network consist of

(1) Expressways and National Highways
(2) State Highways (SH) and Major District Roads (MDR)
(3) Other District Roads (ODR) and Village Roads (VR)
(4) All of the above

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44. The Benkelman Beam Deflection method is used for

(1) Flexible overlay on flexible pavement

(2) Rigid overlay on rigid pavement

(3) Flexible overlay on rigid pavement

(4) Rigid overlay on flexible pavement

45. The width of carriageway for various classes of roads standardised by the Indian Road Congress (IRC) for two lanes without raised kerbs is

(1) 3·75 m

(2) 7·00 m

(3) 7·50 m

(4) 5·50 m

46. The strength of a bridge is termed as MBG loading of 1987. MBG refers to

(1) Model Broad Gauge

(2) Modified Broad Gauge

(3) Modified Budget Grant

(4) Main Broad Gauge

47. The centrifugal force is assumed to act at a height of _____ above the level of the carriageway of the bridge.

(1) 1 m (2) 1·2 m

(3) 1·5 m (4) 1·75 m

48. For all parts of bridge floors accessible only to pedestrains and for all footways, loading should be

(1) 200 kg/m^2 (2) 300 kg/m^2

(3) 400 kg/m^2 (4) 500 kg/m^2

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49. _____ loading is adopted on all roads on which permanent bridges and culverts are constructed.

(1) IRC Class A
(2) IRC Class AA
(3) IRC Class B
(4) IRC Class AB

50. According to the criteria recommended by IRC for Girder Bridges, the limiting load should not cause a deflection more than _____ of the span.

(1) 1/1000 (2) 1/1200
(3) 1/1500 (4) 1/2000

51. The centre-to-centre distance between any two adjacent supports is called the _____ of a bridge.

(1) span (2) clear span
(3) nominal span (4) effective span

52. The scour velocity of the stream is the

(1) Average velocity
(2) Maximum velocity at any time during the year
(3) Velocity which can move the particles of bed materials
(4) Velocity at which a highway bridge is liable to be damaged

53. The bridge structure having a gross length of 6 m or less between the faces of the abatement or extreme vintage boundaries is known as

(1) Causeway (2) Culvert
(3) Short span bridge (4) None of the above

54. In case of navigable rivers, the minimum free board provided is usually

(1) 30 cm to 45 cm
(2) 1·2 m to 1·5 m
(3) 2·4 m to 3·0 m
(4) 1·0 m

कच्च्या कामासाठी जागा / SPACE FOR ROUGH WORK

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55. NATM method of tunnelling is suitable for

a. Subway construction

b. Abnormal geological conditions

c. Soils at medium of shallow depth

d. Tunnelling large sections in very difficult ground

Answer options :

(1) a and b only (2) b and d only

(3) a, c and d only (4) a, b, c and d

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56. Which one of the following shapes is suitable for the construction of tunnel in non-cohesive soils ?

(1) Rectangular (2) Horse-shoe

(3) Egg-shaped (4) Circular

---

57. The tunnels that are made to shortcut minor local obstacles are called

(1) Spiral tunnels (2) Short tunnels

(3) Off-spur tunnels (4) Saddle tunnels

---

58. Which among the following is ***not*** a part of shield equipment ?

(1) Gravel tank (2) Trailing dam

(3) Nipper car (4) Chute

---

59. The following operations are generally employed for the Needle Beam Method of tunnelling :

a. A trench jack is placed on the centre line of the needle beam to support the segment.

b. A monkey drift is driven for a short distance.

c. Drift is widened sideways and supported by lagging segments.

d. The roof of the monkey drift is supported by lagging.

e. The needle beam is slowly skidded forward into the monkey drift.

The correct sequence of operations is

(1) c – d – e – a – b (2) a – b – c – d – e

(3) b – d – e – a – c (4) b – a – e – d – c

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60. Which of the following is a serious health issue in case of workers involved in tunnelling operations ?

(1) Pneumonia
(2) Deafness
(3) Silicosis
(4) Jaundice

61. The amount of fresh air required to maintain ventilation for workers inside the tunnel should be

(1) 1 – 5 m^3/minute
(2) 6 – 14 m^3/minute
(3) 20 – 30 m^3/minute
(4) 30 – 50 m^3/minute

62. The method used to control the amount of dust, where use of water while drilling may be impracticable or undesirable is

(1) Dry system
(2) Vacuum hood system
(3) Control system
(4) Absorption system

63. In compressed air tunnelling, the amount of air required per minute per m^2 of face area is

(1) 1 $m^3/min/m^2$
(2) 6 $m^3/min/m^2$
(3) 10 $m^3/min/m^2$
(4) 20 $m^3/min/m^2$

64. The correct pair showing percentage of total solids in cow-dung and night soil is

	Cow-dung	*Night Soil*
(1)	1·4 – 1·8%	3 – 5%
(2)	1·0 – 2%	2·5 – 4·5%
(3)	18 – 25%	11 – 15%
(4)	70 – 80%	82 – 88%

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65. Which of the following pairs is ***not*** correctly matched ?

(1) Dead end system – Hardy-Cross method

(2) Residual pressure at ferrule point in rural area – 5 m

(3) Distribution reservoir – Central location

(4) Gridiron system – More number of valves

---

66. Consider the following statements pertaining to the sources of supply :

a. Groundwater has low organic content and high dissolved oxygen.

b. Lake water at the bottom has silt and bacteria.

c. River water in floods has low dissolved oxygen and colour.

Which of the above statements is/are correct ?

(1) a only

(2) b only

(3) c only

(4) a, b and c

---

67. As per I.S. 10500, acceptable limit for chlorides in mg/*l* in drinking water is

(1) 100 mg/*l* (2) 250 mg/*l*

(3) 500 mg/*l* (4) 1500 mg/*l*

---

68. Activated sludge process is an

(1) Aerobic attached growth system

(2) Anaerobic attached growth system

(3) Anaerobic suspended growth system

(4) Aerobic suspended system

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69. If B.O.D. of waste water sample after 5 days incubation at 20°C is 100 mg/*l*, deoxygenation rate constant at 20°C is 0·1 per day, ultimate B.O.D. will be

(1) 120·20 mg/*l*

(2) 146·25 mg/*l*

(3) 200·45 mg/*l*

(4) 225.60 mg/*l*

---

70. Which one of the following is the purpose of providing surge tank in pipelines carrying water ?

(1) To store water

(2) To increase pressure in the pipeline

(3) To store overflowing water

(4) To protect the pipeline against water hammer

---

71. In the activated sludge process, sludge volume index is used to decide

(1) Quality of raw sewage

(2) Quality of final effluent

(3) Recirculation ration of sludge

(4) Rate of aeration

---

72. An appurtenance used to connect high level branch sewer to low level branch sewer is

(1) Mahhole

(2) Drop manhole

(3) Inverted siphon

(4) Catch basin

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73. The maximum tolerances in overall length of a 20 m and 30 m metric chain should be respectively

(1) ± 2 mm, ± 8 mm

(2) ± 3 mm, ± 5 mm

(3) ± 5 mm, ± 8 mm

(4) ± 8 mm, ± 5 mm

---

74. Closed contour lines with one or more higher value contours inside it represent

(1) A hill (2) A depression

(3) A cliff (4) A valley

---

75. The lines joining points of equal dip are called

(1) Aclinic lines (2) Isogonic lines

(3) Agonic lines (4) Isoclinic lines

---

76. The magnetic bearing of the sun at noon is 178°. The magnetic declination at the place is

(1) 2° W (2) 2° E (3) 2° N (4) 2° S

---

77. If the lower clamp is tightened and the upper clamp is loosened, the theodolite may be turned

(1) With a relative motion between vernier and graduated scales of the lower plate

(2) Without a relative motion between vernier and graduated scales of the lower plate

(3) Both (1) and (2)

(4) About the horizontal axis

---

78. Total station is used for

(1) Remote object height determination

(2) Establishing horizontal control

(3) Establishing vertical control

(4) All of the above

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79. Sensitivity of a level tube increases with

a. An increase in radius of curvature of the bubble tube.

b. Smoothness of finish of the inner surface of the bubble tube.

Answer options :

(1) Only a is correct (2) Only b is correct

(3) Both are correct (4) None is correct

---

80. If the intercept on a vertical staff is observed as 0·75 m from a tacheometer with the line of sight horizontal, fitted with anallatic lens, the horizontal distance between the tacheometer and the staff station is

(1) 0·75 m (2) 7·5 m (3) 75 m (4) 750 m

---

81. Froude's transition curve is

(1) Cubic spiral (2) Cubic parabola

(3) Bernoulli's lemniscate (4) Ellipse

---

82. A triangulation station selected close to the main station for avoiding intervening obstruction is called

(1) Tie station (2) Eccentric station

(3) Pivot station (4) Satellite station

---

83. An owner of a building requires ₹ 15,000 to repair his building after 5 years. What sum should the owner have to invest now in order to recieve the required amount of money at a rate of compound interest 8% ?

(1) ₹ 10,207·50 (2) ₹ 10,720·50

(3) ₹ 10,270·50 (4) ₹ 10,072·50

---

84. While writing specifications, the following principles shall be adopted :

a. Description of materials

b. Workmanship, tools and plants

c. Protection of new work

d. Clauses of the specifications

e. Expression

Answer options :

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

(3) b and e (4) a, d and e

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85. Purposes of rate analysis are

a. To determine the current rate per unit of an item at the locality

b. To examine the viability of rates offered by contractors

c. To calculate the quantity of materials and labour strength required for project planning

d. To fix labour contract rates

Answer options :

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

(3) a, b and c (4) a, b, c, and d

---

86. The usual practice of bending of a bar near a support is at an angle of

(1) 30° (2) 45° (3) 60° (4) 15°

---

87. For painting corrugated steel sheet, surfaces shall be measured flat and the area worked out shall be increased by

(1) 10% (2) 12% (3) 14% (4) 20%

---

88. Which of the following specifications are ***not*** correct with reference to a brickwork ?

a. Brickwork shall be done in such a way that all joints are full of mortar.

b. For all exposed brickworks, double scaffolding having two sets of vertical supports shall be provided.

c. Bricks required for brick masonry with mud mortar need not be soaked.

Answer options :

(1) a and b only (2) a and c only

(3) b and c only (4) None of the above

---

89. The nominal lead and lift allowed for earthwork in excavations of foundations are

(1) 30 m and 1·5 m (2) 20 m and 2·0 m

(3) 15 m and 3·0 m (4) 10 m and 4·5 m

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90. Which method of depreciation is suitable for finding depreciation of a building having a life of 100 years ?

(1) Constant percentage method

(2) Straight-line method

(3) Sinking fund method

(4) Quantity survey method

---

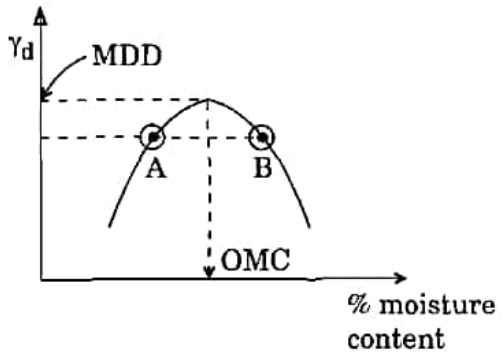
91. For 1 cumec of cement concrete proportion with stone chips 1 : 2 : 4, the required number of cement bags is

(1) 6·34 (2) 6·0

(3) 5·5 (4) 4·5

---

92. In a typical compaction curve as indicated in the diagram, points 'A' and 'B' have same dry densities. Choose the most appropriate statement from the following :



(1) Soil at 'A' will have more swelling potential and less shrinking upon moisture variation, compared to 'B'.

(2) Soil at 'A' will have same swelling and shrinking potential as soil at 'B'.

(3) Soil at 'A' will have less swelling potential and higher shrinking potential compared with soil at 'B'.

(4) The swelling-shrinking potential for soil at 'A' and 'B' cannot be predicted with the given data.

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93. Select the appropriate alternative from the following :

Soil deposit is called as 'over-consolidated', if

(1) $P_o > P_c$

(2) $P_o \leq P_c$

(3) $P_o = P_c$

(4) $P_o < P_c$

where P_o is the present effective overburden pressure and P_c is preconsolidation pressure.

---

94. Following are the statements about the major differences between Terzaghi's analysis ('T') and Meyerhof's analysis ('M') of bearing capacity :

a. 'T' is for homogeneous and isotropic soils but 'M' accounts for non-isotropy.

b. In 'T', the failure surfaces form upto founding level but in 'M', they are extended upto ground level.

c. In 'T', the angle of wedge formed beneath the foundation is assumed to be equal to the angle of internal friction of the soil but in 'M', it varies.

d. In 'T', the load acting on the foundation is concentric and vertical but in 'M', it is assumed as eccentric.

Ascertain the correctness of the above statements and write the correct code.

(1) Statement a is the only correct statement

(2) Statements a and b are correct

(3) Statements b and c are correct

(4) Statements a and d are correct

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95. A 10 m deep canal is constructed in purely cohesive soil having c = 0·2 kg/cm^2, ϕ = 0°, G = 2·5, e = 0·5. The stability number is 0·1. In a canal running in full condition, the factor of safety w.r.t. cohesion against failure of side slopes will be

(1) 1·0

(2) 1·5

(3) 2·0

(4) 2·5

---

96. *Statement A :* Terzaghi's bearing capacity theory assumes strip foundation in the analysis.

Statement B : Terzaghi's theory does not consider development of shear resistance in the soil mass above founding level.

(1) Both the statements A and B are true

(2) Statement A is true but B is false

(3) Statement A is false but B is true

(4) Both the statements A and B are false

---

97. *Statement A :* Plate load test is a short duration test and is not suitable in cohesive soils.

Statement B : Plate load test does not record the total settlement of the test plate in clayey soils.

(1) Both the statements A and B are true but B is not the correct explanation of A

(2) Statement A is true but B is false

(3) Statement A is false but B is true

(4) Both the statements A and B are true and B is the correct explanation of A

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98. A soft saturated clayey soil tested unconfined gave an axial stress of 50 kN/m^2 at failure. The shear strength of the soil is

(1) 50 kN/m^2

(2) 100 kN/m^2

(3) 25 kN/m^2

(4) None of the above

---

99. Match the following :

a.	Electro-osmosis	I.	Provide water free area for work
b.	Under reamed pile	II.	Elliminate differential settlement
c.	Cellular cofferdam	III.	Dewatering of fine grained soil
d.	Raft foundation	IV.	Foundation for expansive soil

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

---

100. A wall 6 m high has a smooth vertical back and retained sand as a backfill which is submerged. The sand has γ_{sat} = 20 kN/m^3 and ϕ = 30°. The total active earth pressure is

(1) 90 kN/m^2

(2) 60 kN/m^2

(3) 120 kN/m^2

(4) None of the above

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परीक्षेचे नांव : महाराष्ट्र **अभियांत्रिकी सेवा (स्थापत्य) (मुख्य) परीक्षा-** 2017 **परीक्षेचा दिनांक :** 17 डिसेंबर, 2017
विषय : प्रश्नपत्रिका क्र. 2 **(स्थापत्य अभियांत्रिकी पेपर - II)**

महाराष्ट्र लोकसेवा आयोगातर्फे घेण्यात आलेल्या **महाराष्ट्र अभियांत्रिकी सेवा (स्थापत्य) (मुख्य) परीक्षा-** 2017 या स्पर्धा परीक्षेच्या प्रश्नपत्रिकेची उत्तरतालिका उमेदवारांच्या माहितीसाठी संकेतस्थळावर प्रसिध्द करण्यात आली होती. त्यासंदर्भात उमेदवारांनी अधिप्रमाणित (Authentic) स्पष्टीकरण / संदर्भ देऊन पाठविलेली लेखी निवेदने, तसेच तज्ज्ञांचे अभिप्राय विचारात घेऊन आयोगाने उत्तरतालिका सुधारित केली आहे. या उत्तरतालिकेतील उत्तरे अंतिम समजण्यात येतील. यासंदर्भात आलेली निवेदने विचारात घेतली जाणार नाहीत व त्याबाबत कोणताही पत्रव्यवहार केला जाणार नाही, याची कृपया नोंद घ्यावी.

उत्तरतालिका - KEY

प्रश्न क्रमांक	उत्तरे			
	संच A	संच B	संच C	संच D
1	2	2	2	4
2	3	1	4	4
3	3	1	3	3
4	2	3	4	3
5	2	4	4	3
6	3	4	3	3
7	3	1	1	2
8	2	2	4	2
9	2	3	2	2
10	2	2	4	3
11	1	4	2	#
12	1	3	4	2
13	3	4	1	2
14	4	4	4	4
15	4	3	4	2
16	1	1	4	4
17	2	4	2	3
18	3	2	4	2
19	2	4	#	3
20	4	2	3	1
21	3	4	1	4
22	4	1	2	2
23	4	4	4	1
24	3	4	1	4
25	1	4	1	3

प्रश्न क्रमांक	उत्तरे			
	संच A	संच B	संच C	संच D
26	4	2	1	3
27	2	4	2	2
28	4	#	2	#
29	2	3	2	1
30	4	1	3	2
31	1	2	1	4
32	4	4	3	2
33	4	1	4	3
34	4	1	3	4
35	2	1	2	1
36	4	2	3	2
37	#	2	4	1
38	3	2	4	1
39	1	3	3	4
40	2	1	3	#
41	4	3	3	3
42	1	4	3	1
43	1	3	2	4
44	1	2	2	3
45	2	3	2	2
46	2	4	3	2
47	2	4	#	2
48	3	3	2	3
49	1	3	2	3
50	3	3	4	2

Date : 28th March, 2018

 # ने दर्शविलेले प्रश्न रद्द करण्यात आलेले आहेत.

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प्रश्न क्रमांक	उत्तरे			
	संच A	संच B	संच C	संच D
51	4	3	2	2
52	3	2	4	3
53	2	2	3	3
54	3	2	2	2
55	4	3	3	2
56	4	#	1	2
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58	3	2	2	1
59	3	4	1	3
60	3	2	4	4
61	2	4	3	4
62	2	3	3	1
63	2	2	2	2
64	3	3	#	3
65	#	1	1	2
66	2	4	2	4
67	2	2	4	3
68	4	1	2	4
69	2	4	3	4
70	4	3	4	3
71	3	3	1	1
72	2	2	2	4
73	3	#	1	2
74	1	1	1	4
75	4	2	4	2

प्रश्न क्रमांक	उत्तरे			
	संच A	संच B	संच C	संच D
76	2	4	#	4
77	1	2	3	1
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99	2	2	2	2
100	2	2	3	3

ने दर्शविलेले प्रश्न रद्द करण्यात आलेले आहेत

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

प्रश्नपुस्तिका क्रमांक
BOOKLET No.

2018

102933

प्रश्नपुस्तिका-I K12 संच क्र. A

स्थापत्य अभियांत्रिकी पेपर – 1

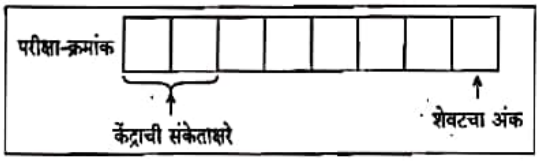
वेळ : 2 (दोन) तास

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

---

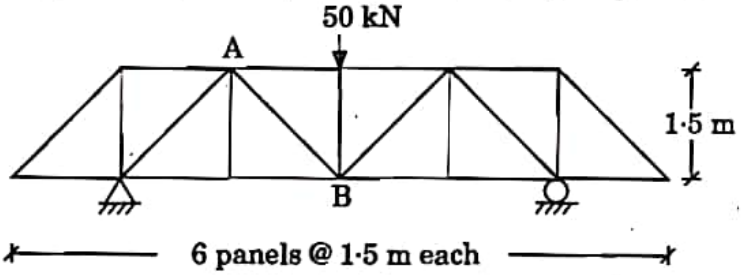
2. For a fixed beam AB, the support B settles by δ downward, then what is the direction of rotation of point A and B ?

(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

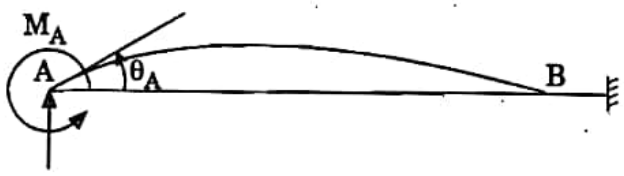


(1) 25 kN (c) (2) $25\sqrt{2}$ kN (t)

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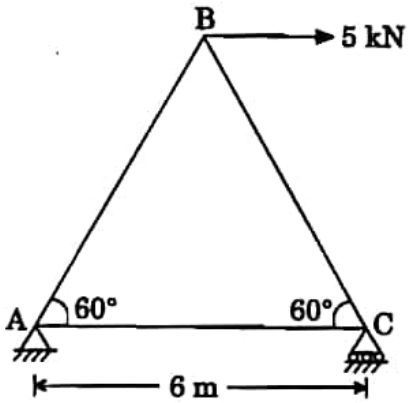
6. Force in the member BC of the truss shown in the figure below is



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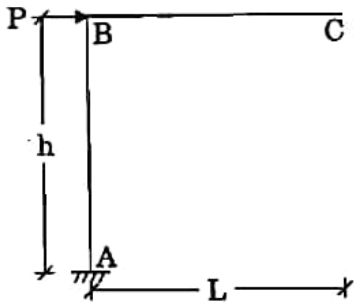
10. A rigid cantilever frame ABC is loaded and supported as shown in the figure below. The horizontal displacement of point C is



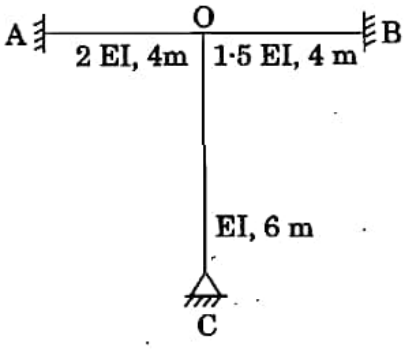
(1) $\frac{2\,Ph^3}{3EI}$

(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

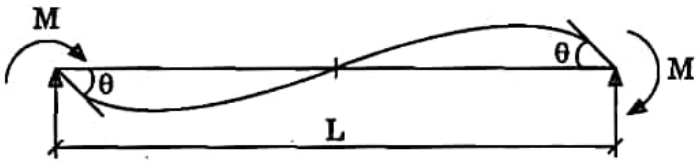
(2) Deformation at j due to a unit force at i

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

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

---

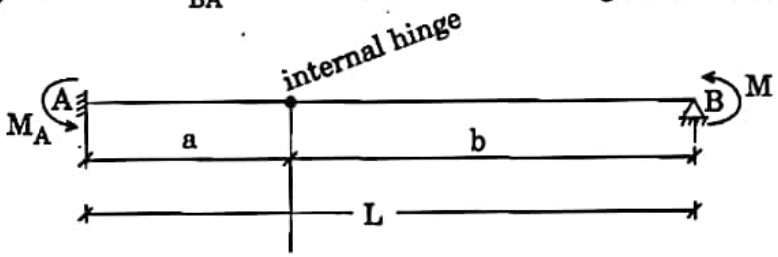
13. A beam EI-constant of span L is subjected to clockwise moments M at both the ends A and B. The rotation of end A works out to be



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

---

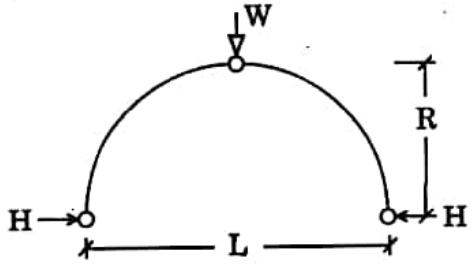
14. Carry-over factor C_{BA} for the beam shown in the figure below is



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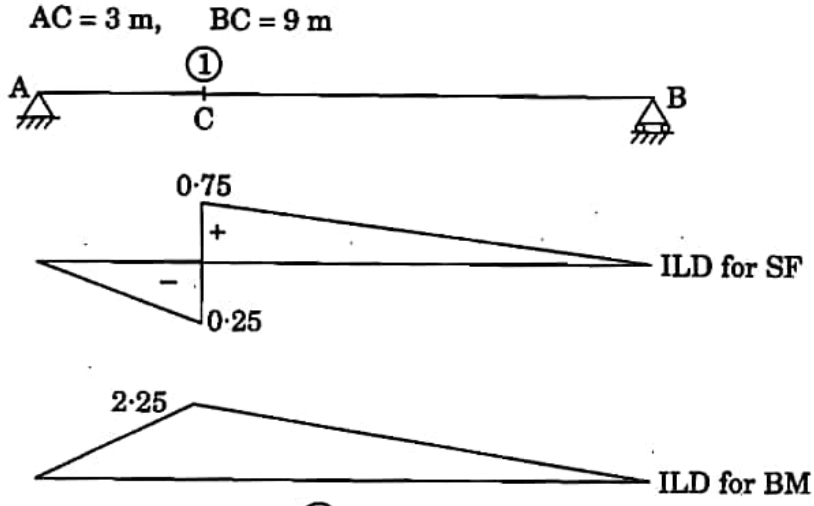
19. The given figure shows ILD for SF and BM at section 1

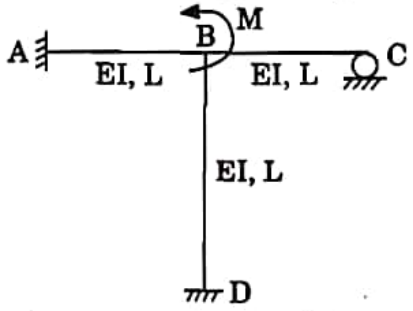


The value of SF and BM at (1) due to concentrated load of 20 kN at mid span will be

(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

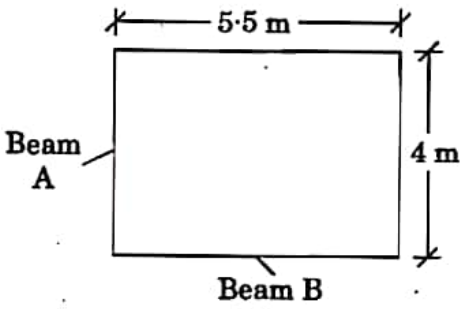
(2) one-fourth of overall thickness of slab

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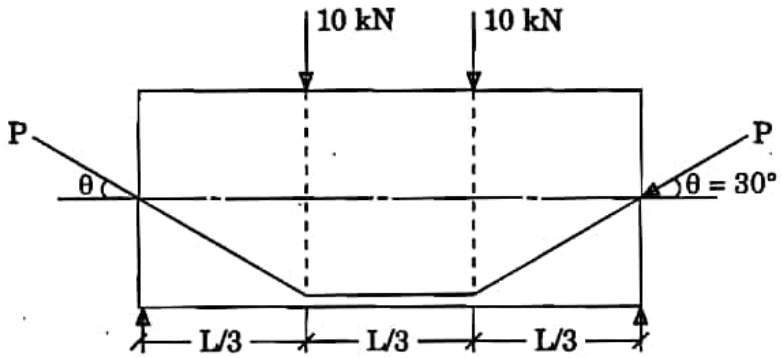
50. A simply supported beam of span 9 m is subjected to two point loads, each of 10 kN acting at $\frac{1}{3}$ of span as shown in the figure. If self-weight of beam is neglected, then how much prestressing force is required to counter-balance the external loads if $\theta = 30°$?



(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

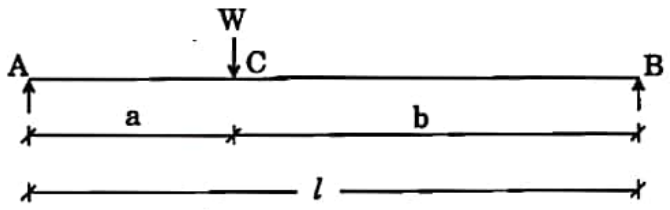
(1) normal stress remains constant in all directions

(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) ± 50 MPa (2) + 50 MPa, – 25 MPa

(3) + 25 MPa, – 50 MPa (4) ± 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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परीक्षेचे नांव : महाराष्ट्र अभियांत्रिकी सेवा (स्थापत्य) (मुख्य) परीक्षा- 2018 **परीक्षेचा दिनांक : 25 नोव्हेंबर, 2018**
विषय : प्रश्नपत्रिका क्र.1 (स्थापत्य अभियांत्रिकी पेपर - I)

महाराष्ट्र लोकसेवा आयोगातर्फे घेण्यात आलेल्या **महाराष्ट्र अभियांत्रिकी सेवा (स्थापत्य) (मुख्य) परीक्षा- 2018** या स्पर्धा परीक्षेच्या प्रश्नपत्रिकेची प्रथम उत्तरतालिका उमेदवारांच्या माहितीसाठी संकेतस्थळावर प्रसिध्द करण्यात आली होती. त्यासंदर्भात उमेदवारांनी अधिप्रमाणित (Authentic) स्पष्टीकरण / संदर्भ देऊन पाठविलेली लेखी निवेदने, तसेच तज्ज्ञांचे अभिप्राय विचारात घेऊन आयोगाने उत्तरतालिका सुधारित केली आहे. या उत्तरतालिकेतील उत्तरे अंतिम समजण्यात येतील. यासंदर्भात आलेली निवेदने विचारात घेतली जाणार नाहीत व त्याबाबत कोणताही पत्रव्यवहार केला जाणार नाही, याची कृपया नोंद घ्यावी.

उत्तरतालिका - KEY

प्रश्न क्रमांक	उत्तरे			
	संच A	संच B	संच C	संच D
1	2	3	4	4
2	#	3	4	3
3	2	1	3	3
4	2	4	4	3
5	3	1	2	1
6	4	3	3	1
7	1	1	4	3
8	1	1	2	3
9	3	4	4	4
10	3	1	1	2
11	4	2	**3**	2
12	1	1	4	#
13	4	2	3	2
14	1	#	3	3
15	4	3	3	2
16	2	1	1	4
17	2	3	1	4
18	1	3	3	1
19	4	2	3	3
20	2	4	4	3
21	2	**4**	2	2
22	1	2	2	4
23	2	4	#	2
24	1	4	2	3
25	1	3	3	4

प्रश्न क्रमांक	उत्तरे			
	संच A	संच B	संच C	संच D
26	1	4	2	2
27	1	2	4	3
28	3	3	4	4
29	3	4	1	3
30	2	2	3	4
31	3	4	3	4
32	1	1	2	3
33	2	**3**	4	1
34	3	4	2	4
35	3	3	3	2
36	1	3	4	#
37	4	3	2	2
38	1	1	3	2
39	3	1	4	3
40	1	3	3	4
41	1	3	4	1
42	4	4	4	1
43	1	2	3	3
44	2	2	1	3
45	1	#	4	4
46	2	2	2	1
47	#	3	#	4
48	3	2	2	1
49	1	4	2	4
50	3	4	3	2

Date - 28th February, 2019

 # ने दर्शविलेले प्रश्न रद्द करण्यात आलेले आहेत.

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प्रश्नपत्रिका क्र.१ (स्थापत्य अभियांत्रिकी पेपर - I)

प्रश्न क्रमांक	उत्तरे			
	संच A	संच B	संच C	संच D
51	3	1	4	2
52	2	3	1	1
53	4	3	1	4
54	**4**	2	3	2
55	2	4	3	2
56	4	2	4	1
57	4	3	1	2
58	3	4	4	1
59	4	2	1	1
60	2	3	4	1
61	3	4	2	1
62	4	3	2	3
63	2	4	1	3
64	4	4	4	2
65	1	3	2	3
66	**3**	1	2	1
67	4	4	1	2
68	3	2	2	3
69	3	#	1	3
70	3	2	1	1
71	1	2	1	4
72	1	3	1	1
73	3	4	3	3
74	3	1	3	1
75	4	1	2	1

प्रश्न क्रमांक	उत्तरे			
	संच A	संच B	संच C	संच D
76	2	3	3	4
77	2	3	1	1
78	#	4	2	2
79	2	1	3	1
80	3	4	3	2
81	2	1	1	#
82	4	4	4	3
83	4	2	1	1
84	1	2	3	3
85	3	1	1	3
86	3	4	1	2
87	2	2	4	4
88	4	2	1	**4**
89	2	1	2	2
90	3	2	1	4
91	4	1	2	4
92	2	1	#	3
93	3	1	3	4
94	4	1	1	2
95	3	3	3	3
96	4	3	3	4
97	4	2	2	2
98	3	3	4	4
99	1	1	**4**	1
100	4	2	2	**3**

Date -28th February, 2019

ने दर्शविलेले प्रश्न रद्द करण्यात आलेले आहेत.

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महाराष्ट्र अभियांत्रिकी सेवा (स्थापत्य) (मुख्य) परीक्षा-2018
परीक्षा दिनांक - 25/11/18

प्रश्नपुस्तिका क्रमांक
BOOKLET No.

2018

203005

प्रश्नपुस्तिका-II L12 संच क्र. A

स्थापत्य अभियांत्रिकी पेपर - 2

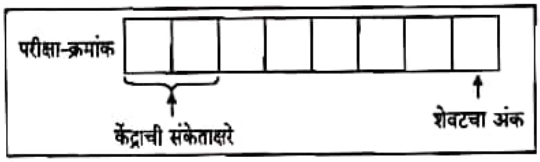
वेळ : 2 (दोन) तास

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".**

पर्यवेक्षकांच्या सूचनेविना हे सील उघडू नये

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

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1. For finding out time 't_2' required to achieve 50% consolidation of 1 m thick clayey strata resting on impermeable rock at bottom and sandy soil at top, a laboratory consolidation test was carried out, using 1 cm thick sample obtained from the same strata. Time "t_1" was taken by it to achieve 25% consolidation, under double drainage condition, in the laboratory.

Choose the correct value of ratio of $\left(\frac{t_2}{t_1}\right)$ from the following :

(1) 4,00,000 (2) 16,000 (3) 1,60,000 (4) None of the above

2. The distance 'D' between centers of piles with top diameter 'd' should ***not*** be less than (from practical consideration)

(1) 2d (2) 3d (3) 4d (4) 5d

3. Match List I and List II and select the correct answer using the codes given below :

	List I (Construction Type)	**List II (Suitable Cofferdam Type)**
(a)	Cut-off trench of a dam to be constructed across flowing river	(i) Cellular sheetpile cofferdam
(b)	Shallow foundation of a bridge pier	(ii) Embankment type cofferdam
(c)	Sequential repetition of underwater foundation work	(iii) Single wall sheetpile cofferdam
(d)	Control of groundwater to prevent entry into deep excavation	(iv) Floating steel cylinder cofferdam

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

4. The void ratio and porosity of a soil sample having equal volume of solids and volume of voids are

	Void ratio	Porosity
(1)	1·0	100%
(2)	0·5	50%
(3)	1·0	50%
(4)	0·5	100%

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5. Let E_2 and E_1 represent compaction energy deployed for compacting soil as per modified compaction test and standard compaction test, as per IS.

Choose from the following correct ratio of $\left(\frac{E_2}{E_1}\right)$:

(1) About $4\frac{1}{2}$ times
(2) About $3\frac{1}{2}$ times
(3) About 2 times
(4) None of the above

---

6. On the same soil sample, both Standard and Modified Proctor compaction tests are conducted in the laboratory. The values of Optimum Moisture Content (OMC) and Maximum Dry Density (MDD) for modified test compared to those for standard compaction test will respectively

(1) Increase, Increase
(2) Decrease, Increase
(3) Increase, Decrease
(4) No change, Increase

---

7. If the permeability, shrinkage and swelling of a compacted soil having same density on dry side of optimum moisture content is compared with compaction on wet side of optimum, the variation in these properties will be

(1) more, less, higher
(2) more, more, higher
(3) more, more, less
(4) less, less, higher

---

8. An embankment has a slope of 30° which was constructed with soil having $C = 30\ kN/m^2$, $\phi = 20°$ and $\gamma = 15\ kN/m^3$. The height of embankment is 20 m. Using Taylor's stability no. $\frac{1}{40}$, the factor of safety with respect to cohesion is

(1) 0·25
(2) 2
(3) 4
(4) 1·5

---

9. The degree of consolidation depends upon

(1) thickness of clay layer
(2) coefficient of permeability
(3) co-efficient of consolidation
(4) All the above

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10. The loss of head due to sudden expansion of a pipe is given by

(1) $h_L = \frac{V_1^2 - V_2^2}{2g}$ (2) $h_L = \frac{0{\cdot}5\, V^2}{2g}$

(3) $h_L = \frac{(V_1 - V_2)^2}{2g}$ (4) None of the above

11. Bernoulli's equation is derived making assumption that

(1) the flow is uniform and incompressible

(2) the flow is non-viscous, uniform and steady

(3) the flow is steady, non-viscous, incompressible and irrotational

(4) None of the above

12. For the laminar flow through a circular pipe

(1) the maximum velocity = 1·5 times the average velocity

(2) the maximum velocity = 2·0 times the average velocity

(3) the maximum velocity = 2·5 times the average velocity

(4) None of the above

13. Depth at which specific energy is minimum is known as

(1) Critical depth (2) Conjugate depth

(3) Alternate depth (4) Normal depth

14. In a rectangular channel section, if the channel depth is 2·0 m, the specific energy at critical depth is

(1) 3·0 m (2) 1·33 m (3) 2·5 m (4) 1·5 m

15. Which of the following statements is correct ?

(1) Centrifugal pumps convert mechanical energy into hydraulic energy by thrust of piston

(2) Reciprocating pumps convert mechanical energy into hydraulic energy by means of centrifugal forces

(3) Centrifugal pumps convert mechanical energy into hydraulic energy by means of centrifugal force

(4) Reciprocating pumps convert hydraulic energy into mechanical energy

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16. Dynamic viscosity (μ) has the dimensions as

(1) MLT^{-2} (2) $ML^{-1}T^{-1}$ (3) $ML^{-1}T^{-2}$ (4) $M^{-1}L^{-1}T^{-1}$

17. The submerged body will be in stable equilibrium if

(1) The centre of buoyancy B is below the centre of gravity G
(2) The centre of buoyancy B coincides with G
(3) The centre of buoyancy B is above the metacentre M
(4) The centre of buoyancy B is above G

18. Continuity equation deals with the law of conservation of

(1) mass (2) momentum
(3) energy (4) None of the above

19. The discharge through a single-acting reciprocating pump is

(1) $Q = \frac{ALN}{60}$ (2) $Q = \frac{2ALN}{60}$ (3) $Q = ALN$ (4) $Q = 2ALN$

where A = cross-sectional area of cylinder or piston
L = length of stroke
N = r.p.m. of the crank

20. A turbine is called impulse if at the inlet of the turbine

(1) total energy is only kinetic energy
(2) total energy is only pressure energy
(3) total energy is the sum of kinetic energy and pressure energy
(4) None of the above

21. During suction stroke of a reciprocating pump, the separation may take place

(1) at the end of suction stroke
(2) in the middle of suction stroke
(3) at the beginning of suction stroke
(4) None of the above

22. The specific speed (N_s) of a pump is given by the expression

(1) $N_s = \frac{N\sqrt{Q}}{H_m^{5/4}}$ (2) $N_s = \frac{N\sqrt{P}}{H_m^{3/4}}$

(3) $N_s = \frac{N\sqrt{Q}}{H_m^{3/4}}$ (4) $N_s = \frac{N\sqrt{P}}{H_m^{5/4}}$

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23. Kaplan turbine is a/an
(1) impulse turbine
(2) radial flow impulse turbine
(3) axial flow reaction turbine
(4) radial flow reaction turbine

24. A turbine is a device which converts
(1) Hydraulic energy into mechanical energy
(2) Mechanical energy into hydraulic energy
(3) Kinetic energy into mechanical energy
(4) Electrical energy into mechanical energy

25. In the inlet part of the jet impinging on a Pelton bucket, the velocity of whirl V_{w1} is equal to
(1) absolute velocity of jet at inlet V_1
(2) relative velocity of jet at inlet V_{r1}
(3) zero
(4) None of the above

26. If the turbine has kinetic energy and pressure energy of water at its inlet, then such turbine is known as
(1) impulse turbine
(2) reaction turbine
(3) Pelton wheel turbine
(4) low head turbine

27. Which component is ***not*** provided to Pelton wheel turbine ?
(1) Penstock (2) Jet (3) Casing (4) Draft tube

28. The artesian aquifer is one where
(1) water surface under the ground is at atmospheric pressure
(2) water table serves as upper surface of zone of saturation
(3) water is under pressure between two impervious strata
(4) None of the above

29. Lysimeter is used to measure
(1) Infiltration
(2) Evaporation
(3) Evapotranspiration
(4) Vapour pressure

30. Horton's infiltration capacity is given as
(1) $f = f_o + [f_c - f_o]\, e^{-kt}$
(2) $f = f_o - [f_c + f_o]\, e^{-kt}$
(3) $f = f_o - [f_c - f_o]\, e^{-kt}$
(4) $f = f_c + [f_o - f_c]\, e^{-kt}$

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31. Weibull formula is

(1) $P = \left(\frac{m}{N+1}\right)$ (2) $P = \left(\frac{m}{N-1}\right)$

(3) $P = \left(\frac{N+1}{m}\right)$ (4) $P = \left(\frac{N-1}{m}\right)$

(where m is order number and N is number of years of record)

32. The term base flow denotes

(1) delayed groundwater flow reaching a stream

(2) delayed groundwater and snowmelt reaching a stream

(3) delayed groundwater and interflow

(4) the annual minimum flow in a stream

33. Following is ***not*** the method of apportionment of total cost of multipurpose reservoir :

(1) Remaining benefit method (2) Use of facilities method

(3) Equal apportionment (4) Direct method

34. Owing to the storage effect, the peak of the outflow hydrograph will be smaller than that of the inflow hydrograph. This reduction in peak value is known as

(1) Lag (2) Attenuation

(3) Routing (4) Prism storage

35. An IUH is a direct runoff hydrograph

(1) of one cm magnitude due to rainfall excess of 1-h duration

(2) that occurs instantaneously due to a rainfall excess of 1-h duration

(3) of unit rainfall excess precipitating instantaneously over the catchment

(4) occurring at any instant in long duration

36. The example of aquifuge is

(1) Clay layer (2) Sandy layer

(3) Solid granite rocks (4) Silty clay layer

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37. The ratio of the quantity of water stored in the root zone of the crops to the quantity of water actually delivered in the field is
(1) Water conveyance efficiency (2) Water application efficiency
(3) Water use efficiency (4) None of the above

38. In border strip method of irrigation, the width of strip is
(1) 5 – 10 m (2) 10 – 20 m (3) 20 – 30 m (4) 25 – 30 m

39. The duty of irrigation water for a given crop is maximum
(1) on the field (2) at the head of main canal
(3) at the head of water course (4) near the distributary

40. A channel designed by Lacey's theory has a mean velocity of one m/s. The silt factor is unity. The hydraulic mean radius will be
(1) 2·5 m (2) 2·0 m (3) 1·0 m (4) 0·5 m

41. In design of spillway when $H_e = H_d$, the value of 'C' is
(1) 1·00 (2) 1·33 (3) 2·00 (4) 2·20

42. Hygroscopic water is defined as the
(1) readily available water for the use of plants.
(2) water which is adsorbed by the particles of the dry soil from the atmosphere.
(3) total water content of the soil when all pores are filled with water.
(4) water held by the soil under capillary action.

43. In case of non-availability of space due to topography, the most suitable spillway is
(1) Straight drop spillway (2) Shaft spillway
(3) Chute spillway (4) Ogee spillway

44. The channel after obtaining its section and longitudinal slope will be said to be in
(1) Initial regime (2) Permanent regime
(3) Final regime (4) Absolute regime

45. The silt load in the stream does ***not*** depend upon
(1) nature of the soil in the catchment area
(2) topography of the catchment area
(3) intensity of rainfall
(4) alignment of dam

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46. Match the design speed recommended for various roads by IRC 86 : 1983

	List I		List II
(a)	Collector roads	(i)	30 kmph
(b)	Local roads	(ii)	80 kmph
(c)	Arterial roads	(iii)	60 kmph
(d)	Sub-arterial roads	(iv)	50 kmph

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

47. IRC recommended % values of camber for different types of road surface can be arranged in descending order of following roads :

a. Water bound macadam road

b. Thin bituminous surface road

c. Cement-concrete road

d. Earth road

Answer Options :

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

(3) d, a, b, c (4) c, b, a, d

48. The expression for the length of a transition curve (L_s) in meters is

(1) $L_s = \frac{V^3}{CR}$ (2) $L_s = \frac{V^3}{16\,CR}$

(3) $L_s = \frac{V^3}{24\,CR}$ (4) $L_s = \frac{V^3}{46{\cdot}5\,CR}$

where

C = Rate of change of radial acceleration in m/s^3

R = Radius of the circular curve in metres, and

V = Speed of vehicle in kmph

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49. The design speed adopted for design of rotaries in urban areas of India is

(1) 30 kmph (2) 40 kmph (3) 50 kmph (4) 60 kmph

50. Match the following :

	List I	List II
(a)	Stop signs	(i) Circular in shape
(b)	Give way signs	(ii) Equilateral triangle with its apex pointing upwards
(c)	Speed limit signs	(iii) Octagonal shape
(d)	Warning signs	(iv) Inverted triangle with its apex pointing downwards

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

51. The dowel bars are used in rigid pavements for

(1) resisting tensile stresses
(2) resisting bending stresses
(3) resisting shear stresses
(4) transferring load from one portion to another

52. Group index method of designing flexible pavement is based on

a. Plasticity index
b. Shear strength
c. CBR value
d. Percent fines

Answer Options :

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

53. Grade separation

a. is for crossing traffic
b. is to minimize delay and hazard
c. a cheaper option
d. increases discomfort and inconvenience

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

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54. Consider the following statements :

Collision diagram is used to

a. study accident patterns
b. eliminate accidents
c. determine remedial measures
d. make statistical analysis of accidents

Answer Options :

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

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55. A bridge has a linear waterway of 150 metres constructed across a stream whose natural linear waterway is 200 metres. If the average flood depth is 3 metres and average flood discharge is 1200 m^3/sec, the velocity of approach is

(1) 2·0 m/sec (2) 2·66 m/sec (3) 6·0 m/sec (4) 8·0 m/sec

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56. The width of carriageway required will depend on the intensity and volume of traffic anticipated to use the bridge.

a. Except on minor village roads all bridges must provide for at least two lane width
b. The minimum width of carriageway is 4·25 m for one lane bridge
c. The minimum width of carriageway is 3·75 m for one lane bridge
d. The minimum width of carriageway is 7·5 m for two lane bridge

Which of the statements given above is/are ***incorrect*** ?

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

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57. Which of the following shall be considered while designing high level bridges for buoyancy effect ?

(1) Full buoyancy for the superstructure
(2) Full buoyancy for the abutments
(3) Buoyancy forces due to submerged part of the substructure and foundation
(4) Partial buoyancy for superstructure

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58. The normal depth of scour for alluvial rivers is determined by Lacey's formula

(1) $\sqrt{0\cdot475}\left(\frac{f}{Q}\right)$
(2) $0\cdot475\left(\frac{Q}{f}\right)^3$
(3) $0\cdot475^3\sqrt{\frac{f}{Q}}$
(4) $0\cdot475^3\sqrt{\frac{Q}{f}}$

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59. Roller bearings are used in bridges for the span of
(1) 18 to 24 m (2) 12 to 18 m (3) 6 to 12 m (4) Up to 6 m

60. The maximum scour depth dm for condition of flow at noses of piers is
(1) 1·50 d (2) 1·75 d (3) 2·00 d (4) 2·75 d

61. For high level bridges, the freeboard should ***not*** be less than
(1) 200 mm (2) 400 mm (3) 600 mm (4) 800 mm

62. As per IRC specifications, the minimum cement content in concrete is _____ for major bridges.
(1) 340 kg/m^3 (2) 350 kg/m^3
(3) 360 kg/m^3 (4) 370 kg/m^3

63. For IRC class A and B loading, the impact factor, for R.C.C. bridges having spans more than 45 metres, is taken as
(1) 0·078 (2) 0·088 (3) 0·098 (4) 0·154

64. Which pattern of the drilling is ***not*** used for shafts ?
(1) Central wedge cut (2) End wedge cut
(3) Vertical wedge cut (4) Alternate wedge cut

65. From the economy point of view, tunnelling is advisable when the depth of open cut is more than
(1) 6 m (2) 12 m (3) 18 m (4) 24 m

66. Match the following :

	List I	List II
(a)	Firm ground	(i) Needing instant support all round
(b)	Running ground	(ii) Needing instant support for roof
(c)	Self-supporting ground	(iii) No need of instant support for roof
(d)	Soft ground	(iv) Soil stands supported for short period and short length

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

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67. Which of the following methods is suitable for the construction of large-sized railway or highway tunnels ?

(1) Forepoling method (2) American method

(3) Case method (4) Full face method

68. Match the List I (Shape of Tunnel) with List II (Characteristics) :

	List I		List II
(a)	Circular section	(i)	Provides more working space
(b)	Horseshoe section	(ii)	Provides greatest cross-sectional area for least perimeter
(c)	Egg shape	(iii)	Vertical sides with flat floor
(d)	Segmental cross-section	(iv)	Provides least cross-section area at the bottom

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

69. In order to maintain the desired shape of the tunnel, the cross section of the tunnel must be checked at a regular interval of

(1) 2 m to 3 m (2) 4 m to 6 m (3) 5 m to 7 m (4) 8 m to 15 m

70. *Assertion (A) :* Faces for attacking the excavation and construction of tunnels are opened by constructing pilot tunnels.

Reasoning (R) : Pilot tunnels are suitable at locations when horizontal approach to the centre line of tunnel is shorter than deep vertical shafts.

(1) Both (A) and (R) are true and (R) is the correct explanation of A

(2) (A) is true and (R) is false

(3) (A) is false and (R) is true

(4) Both (A) and (R) are false

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71. Which of the following methods is generally considered the most efficient system for ventilation of tunnels ?

(1) Driving a shaft through the tunnel

(2) Driving a drift through the top portion

(3) Blow in method

(4) Combination of blowing and exhausting

---

72. In case of long tunnels, the drainage system consists of sump wells which are located at regular intervals of about

(1) 50 m to 100 m (2) 100 m to 200 m

(3) 200 m to 300 m (4) 300 m to 500 m

---

73. Air valves or Air-relief valves are provided at

(1) Summits (2) Valleys

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

---

74. Which of the following treatments reduces salinity of water ?

a. Alum coagulation, flocculation and settling

b. Carbon filtration

c. Reverse osmosis

d. Electro dialysis

Answer Options :

(1) Only a and b

(2) Only b and c

(3) Only c and d

(4) Only b, c and d

---

75. The minimum velocity of flow in a sewer should be ideally

(1) equal to self-cleansing velocity

(2) equal to non-scouring velocity

(3) less than self-cleansing velocity

(4) more than non-scouring velocity

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76. Sewer lines having difference of more than 600 mm in the water lines and invert level of two sewers are connected with a

(1) Siphon (2) Manhole

(3) Inspection chamber (4) Drop manhole

77. Generally the period chosen for a standard B.O.D. test is

(1) 1 day (2) 5 days

(3) 8 days (4) 20 days

78. For rapid sand filter, sand should have the following specifications :

(1) Effective size 0·1 – 0·5 mm
Uniformity co-efficient = 2 to 4

(2) Effective size 0·2 – 0·5 mm
Uniformity co-efficient = 2 to 3

(3) Effective size 0·45 – 0·7 mm
Uniformity co-efficient = 1·3 to 1·7

(4) Effective size 0·7 – 0·9 mm
Uniformity co-efficient = 1 to 5

79. If waste water is disposed off into a natural stream, the maximum dissolved oxygen depletion occurs in the zone of

(1) degradation (2) active decomposition

(3) clearer water (4) recovery

80. In a sedimentation tank design, surface overflow rate (S.O.R.) is calculated as

(1) Surface area/velocity of water Q/V/V

(2) Discharge/plan area Q/B×L

(3) Volume of tank/discharge V/Q

(4) Surface area/settling velocity of the particle A/V_s

81. The waste water treatment unit which is installed to remove floating substances like grease, oil, fats, waxes, etc. is

(1) skimming tank (2) detritus tank

(3) sedimentation tank (4) None of the above

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82. An alidade in which one edge is bevelled is called as

(1) Soft edge (2) Fiducial edge

(3) Telescopic edge (4) Swivel edge

83. Contour interval is the

(1) vertical distance between two consecutive contours

(2) horizontal distance between two consecutive contours

(3) vertical distance between two points on the same contour

(4) horizontal distance between two points on the same contour

84. The length of a simple circular curve of radices R metres and intersection angle D degrees will be

(1) $R \cdot \frac{D}{2}$ (2) $\frac{\pi}{180} \cdot R \cdot \frac{D}{2}$

(3) $\frac{\pi}{180} \cdot R \cdot \frac{D}{4}$ (4) $\frac{\pi}{180} \cdot R \cdot D$

85. The height of an instrument is the

(1) Height of the instrument above the ground

(2) Height between ground and telescope

(3) Elevation of the plane of sight

(4) Reduced level of station

86. If a tachometer is fitted with an anallactic lens, then,

(1) Additive constant is 100 and multiplying constant is zero

(2) Multiplying constant is 100 and additive constant is zero

(3) Both additive and multiplying constants are 100

(4) Both multiplying and additive constants are 50

87. Following is constant for a contour map :

(1) Horizontal equivalent

(2) Benchmark

(3) Contour interval

(4) Topography

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88. The combined correction due to curvature and refraction is given by

(1) $0{\cdot}095\ d^2$ (2) $0{\cdot}01122\ d^2$

(3) $0{\cdot}06735\ d^2$ (4) $0{\cdot}572\ d^2$

(where d is in km)

---

89. Reiteration method is also called as

(1) Method of series (2) Repetition method

(3) Direction method (4) Both (1) and (3)

---

90. The expression for sensitivity of the bubble tube (α) can be taken as, _____

where n = No. of divisions

s = Net staff reading

d = Distance

R = Radius of curvature

l = Length of one division

(1) $\alpha = \frac{s}{nd} \times 206265$ seconds (2) $\alpha = \frac{d}{ns} \times 206265$ seconds

(3) $\alpha = \frac{nlD}{R}$ radians (4) $\alpha = \frac{s}{nR} \cdot \frac{l}{D}$

---

91. Closing error in theodolite traverse survey is given as

(1) $e = \sqrt{(\Sigma L^2 + \Sigma D^2)^2}$ (2) $e = \sqrt{(\Sigma L)^2 + (\Sigma D)^2}$

(3) $e = \sqrt{\Sigma L + \Sigma D}$ (4) $e = \sqrt{(\Sigma L)^2 - (\Sigma D)^2}$

---

92. If the length of 16 mm diameter bar is 10 m, then its weight is

(1) 16·5 kg (2) 16·9 kg

(3) 15·8 kg (4) 16·2 kg

---

93. Security deposit is

(1) deposited at the time of filling tender

(2) deposited by the contractor whose tender is accepted

(3) deposited at the time of opening tenders

(4) deposited for fair competition

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94. In order to compute the quantities of R.C.C. beams, lengths of beams are measured to the

(1) nearest millimetre (2) nearest half centimetre

(3) nearest centimetre (4) nearest inch

---

95. In case of which type of contract, unbalanced tender is ***not*** possible ?

(1) Open tender (2) Item rate contract

(3) Percentage rate contract (4) Unit price contract

---

96. Which of the following types of contract is used for execution of large works financed by public bodies or the government ?

(1) Item rate contract (2) Percentage rate contract

(3) Cost plus type contract (4) Target contract

---

97. *Assertion (A) :* Earnest money deposit is usually 1% to 2% of the total estimated cost of the work.

Reasoning (R) : Earnest money deposit prevents unnecessary and unhealthy competition.

(1) Both (A) and (R) are true (2) Both (A) and (R) are false

(3) (A) is true and (R) is false (4) (A) is false and (R) is true

---

98. Equation for cement requirement in tonnes for four-storey R.C.C. framed building (super structure) recommended by C.B.R.I. is

(1) 0·153 A + 0·57 (2) 0·145 A + 0·54

(3) 0·182 A – 0·35 (4) 2·26 A + 66·8

(where A is plinth area in sq. mt)

---

99. While submitting tender by three envelope method, which envelope contains rates/amount offered by the tenderer ?

(1) Envelop : 3 (2) Envelope nos : 1 and 2

(3) Envelope : 1 (4) None of the above

---

100. The length of L-bend for Tor steel to be provided at each end of the reinforcing bars is

(1) 12 times diameter (2) 6 times diameter

(3) 3 times diameter (4) 150 mm

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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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महाराष्ट्र स्थापत्य अभियांत्रिकी सेवा मुख्य परीक्षा-2019
परीक्षा दि. 24/11/2019

A → संच क्रमांक

2019

T13

प्रश्नपुस्तिका क्रमांक
BOOKLET NO.

प्रश्नपुस्तिका - I

स्थापत्य अभियांत्रिकी पेपर - 1

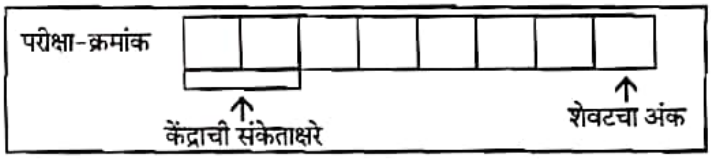
वेळ : 2 (दोन) तास

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 बॉल्पेनने** 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 बॉल्पेन 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''.**

पर्यवेक्षकांच्या सूचनेविना हे सील उघडू नये

ताकीद

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

पुढील सूचना प्रश्नपुस्तिकेच्या अंतिम पृष्ठावर पहा

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1. For the formwork design, IS-456-2000 suggested the deviation from specified dimensions of cross section of columns and beams at _____.

(1) +12 mm , −6 mm (2) +50 mm , −12 mm

(3) +25 mm , −25 mm (4) +12 mm , −12 mm

---

2. If the compressive strength of concrete increases, then tensile strength is also increases, but at a _____.

(1) Increasing rate (2) Decreasing rate

(3) Constant rate (4) Exponential increasing rate

---

3. The brick piece obtained by cutting a triangular portion of the brick such that half a headers and half a stretcher are obtained on adjoining cut faces is called as :

(1) Queen closer (2) Mitred closer

(3) King closer (4) Three-Quarter Bat

---

4. Maximum water-cement ratio and minimum cement content for moderate exposure used in plain cement concrete are _____ ; _____ respectively, as per IS-456-2000.

(1) 0.60 ; 220 kg/m^3 (2) 0.60 ; 240 kg/m^3

(3) 0.50 ; 250 kg/m^3 (4) 0.55 ; 260 kg/m^3

---

5. Which of the following tests is not a test for evaluating workability of concrete ?

(1) Slump Test (2) Flow Test

(3) Compacting factor Test (4) Le-Chatellier Test

---

6. A well caisson is a foundation facilating structure sunk in the ground or water ; which is :

(1) Open at top as well as at bottom.

(2) Open at top and closed at bottom.

(3) Open at bottom and closed at top.

(4) Closed at top as well as at bottom.

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7. One of the following is **not** a principle related to thermal insulation :

(1) Thermal resistance is directly proportional to thickness of a material.

(2) Provision of air gap plays an important role in thermal insulation.

(3) Transfer of heat from outside to inside increases.

(4) Thermal resistance of a building depends on orientation also.

---

8. _____ are provided as a protective coatings to walls at its top to prevent seepage of water.

(1) Corbels (2) Cornica (3) Copings (4) Floating

---

9. Who had discovered direct relationship between water-cement ratio and strength of concrete ?

(1) Jon Abraham (2) Abraham Lincoln

(3) Duff Abrams (4) Albert Pinto

---

10. One of the following measure **could not** reduce or eliminate plastic shrinkage cracks :

(1) Erect temporary wind breakers.

(2) Concrete should be poured in layers.

(3) Erect temporary roof.

(4) Reduce the time between placing and finishing.

---

11. How much is the Carbon Content (%) in hard-steel ?

(1) 0.5 - 0.8 (2) 0.8 - 1.5 (3) 0.3 - 0.5 (4) 0.15 - 0.3

---

12. Fire load, a fire risk criteria to classify occupancies, for a building having an area of 100 m^2 with combustible material of 1,000 kg having calorific value of 4,000 kcal/kg will be :

(1) 4,00,000 kcal/m^2 (2) 40,000 kcal/m^2

(3) 250 kcal/m^2 (4) 25 kcal/m^2

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13. The shear force and bending moment are zero at the free end of a cantilever beam, if it carries a :

(1) Point load at the free end.

(2) Point load at the middle of its length.

(3) Uniformly distributed load over the whole length.

(4) None of the above.

---

14. A steel rod of c/s area 100 mm^2 and 1 m long is subjected to a tensile force of 40 kN. What is the total elongation of the rod ? If modulus of elasticity of steel is 200 GPa.

(1) 0.5 mm (2) 0.7 mm (3) 1.2 mm (4) 2.0 mm

---

15. A simply supported beam carries couple at a point on its span, the shear force :

(1) Varies by cubic law (2) Varies by parabolic law

(3) Varies linearly (4) Is uniform throughout

---

16. Euler buckling load for one end fixed and the other hinged is given by :

(1) $\frac{\pi^2 EI}{l^2}$ (2) $\frac{2\pi^2 EI}{l^2}$ (3) $\frac{4\pi^2 EI}{l^2}$ (4) $\frac{\pi^2 EI}{4l^2}$

---

17. A point in a strained material is subjected to two mutually perpendicular stresses of 150 MPa (tensile) and 50 MPa (compressive), then what will be the magnitude of maximum shear stress in the component ?

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

---

18. Euler's formula for buckling of column does not hold good if slenderness ratio $\left(\frac{le}{K}\right)$ is _____ for mild steel column.

(1) Less than 80 (2) Greater than 90

(3) 120 - 160 (4) 90 - 120

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19. Maximum deflection of a simply supported beam with the total uniformly distributed load 'W' is :

(1) $\frac{Wl^3}{384EI}$ (2) $\frac{5}{384}\frac{Wl^3}{EI}$ (3) $\frac{Wl^3}{48EI}$ (4) $\frac{5}{48}\frac{Wl^3}{EI}$

20. If a prismatic bar of uniform c/s 'A' and length 'L' is suspended from top, then the elongation of bar due to its self weight only is _____. Where, E is modulus of elasticity of bar material and γ is the density of bar.

(1) $\frac{\gamma L^2}{2E}$ (2) $\frac{\gamma L^2}{3E}$ (3) $\frac{\gamma L^2}{5E}$ (4) $\frac{\gamma L^2}{6E}$

21. The relation governing the simple bending of beam is :

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

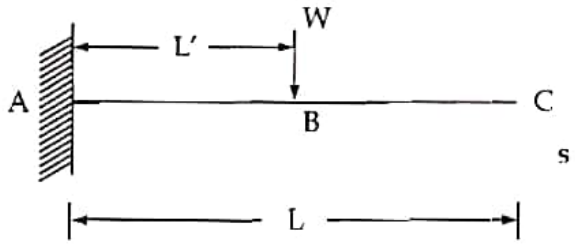
22. A steel bar of 5 mm is heated from 15° to 40°C and it is free to expand. The bar will induce _____.

(1) No stress (2) Shear stress
(3) Tensile stress (4) Compressive stress

23. A simply supported beam AB of span 10 m carries a point load W = 10 kN at C such that AC = 3 m and BC = 7 m, maximum deflection occur _____.

(1) at C (2) at centre of span
(3) between A and C (4) between B and C

24. Which of the following is true in the following figure ?



(1) Deflection at C = deflection at B + $\theta_B(L - L')$

(2) Deflection at C = $\frac{L}{L'}$ × deflection at B

(3) Deflection at C = deflection at B + $\theta_C(L - L')$

(4) Both (1) and (3)

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25. A statically indeterminate structure is the one which :

(1) Cannot be analyzed at all

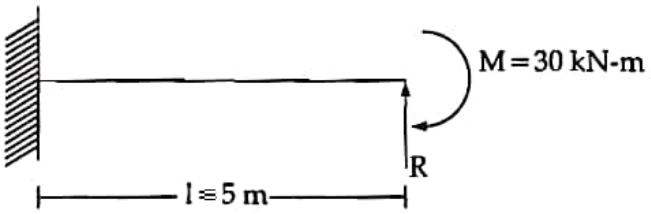
(2) Can be analyzed using equations of statics only

(3) Can be analyzed using equations of statics and compatibility equations

(4) Can be analyzed using equations of compatibility only

---

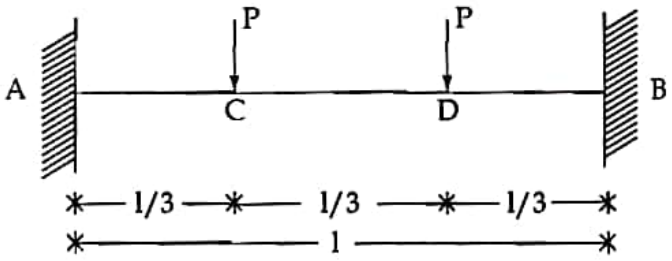
26. In the propped cantilever as shown in figure, the value of propped reaction 'R' will be :



(1) 9 kN (2) 6 kN (3) 3 kN (4) 2 kN

---

27. A fixed beam AB of length 'l' having constant flexural rigidity EI carries two loads P at its third points C and D as shown in figure.



Numerically, maximum bending moment will occur :

(1) at C and at D and will be equal to $\frac{2}{9}$Pl

(2) between C and D and will be equal to $\frac{Pl}{9}$

(3) at A and at B and will be equal to $\frac{2}{9}$Pl

(4) between A and C and also between B and D and will be equal to $\frac{Pl}{9}$

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28. Maximum deflection for a simply supported beam subjected to udl 'W' throughout span 'l' is :

(1) $\frac{Wl^3}{48EI}$ (2) $\frac{Wl^4}{48EI}$ (3) $\frac{5}{384}\frac{Wl^3}{EI}$ (4) $\frac{5}{384}\frac{Wl^4}{EI}$

---

29. The moment required to rotate the near end of a prismatic beam through a unit angle without translation, the far end being simply supported, is given by :

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

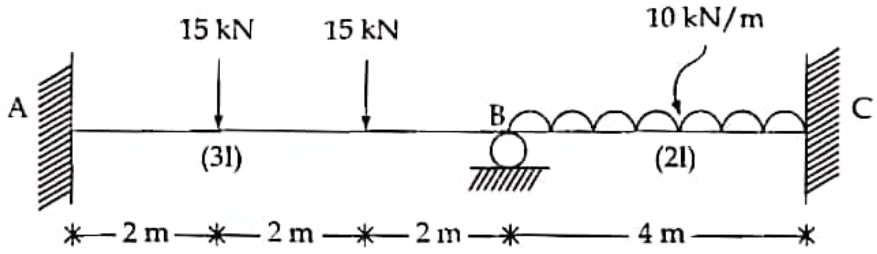
---

30. A two hinged semi-circular arch of radius R carries a concentrated load W at the crown. Assuming uniform flexural rigidity, the horizontal thrust at each support will be :

(1) $\frac{W}{2\pi}$ (2) $\frac{W}{\pi}$ (3) $\frac{4}{3} \cdot \frac{WR}{\pi}$ (4) $\frac{W}{2}$

---

31. A two span continuous beam ABC is as shown in figure below. The distribution factors at joint B are :



(1) 0.4, 0.6 (2) 0.6, 0.4 (3) 0.5, 0.5 (4) 0.55, 0.45

---

32. The deflection at the free end of a cantilever of rectangular cross-section due to certain loading is 0.8 cm. If the depth of the section is doubled keeping the width same, then the deflection at the free end due to the same loading will be :

(1) 0.1 cm (2) 0.4 cm (3) 0.8 cm (4) 1.6 cm

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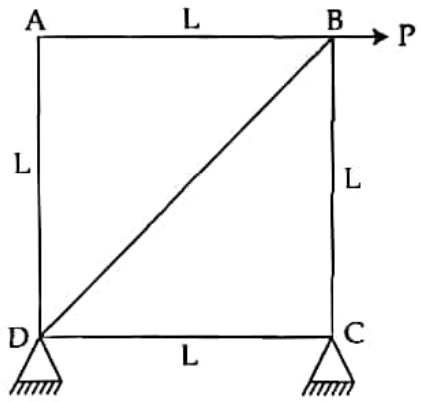
33. What is the force in member AB of the pin-jointed frame as shown below ?



(1) P (tension)

(2) P (compression)

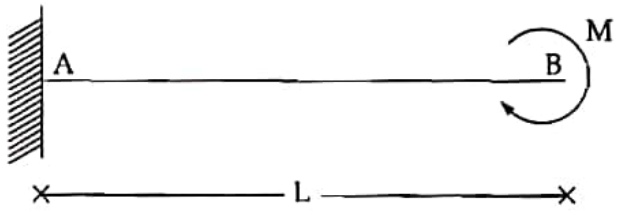
(3) $\frac{P}{\sqrt{2}}$ (compression)

(4) Zero

---

34. A cantilever beam AB of span 'L' is subjected to a moment 'M' at the free end as shown in figure. What is the slope and deflection at free end B ?

Consider same c/s and material. (i.e, EI is same)



(1) $\frac{ML}{EI}, \frac{ML^2}{2EI}$ (2) $\frac{M}{LEI}, \frac{ML^2}{EI}$ (3) $\frac{2ML}{EI}, \frac{2ML^2}{EI}$ (4) $\frac{ML}{EI}, \frac{2ML^2}{EI}$

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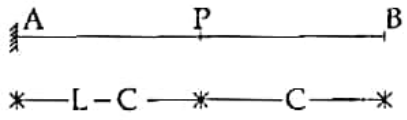
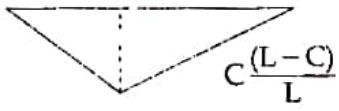
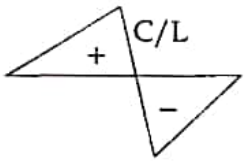
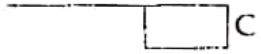
35. Influence line diagram for B.M. at P for cantilever as shown is :



(1)

(2) 

(3) 

(4) 

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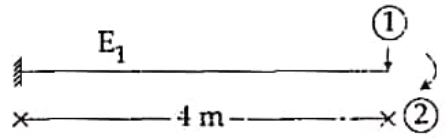
36. Displacement coordinators for the beam are as shown in figure. The flexibility matrix is given by :



(1) $\frac{1}{E_1}\begin{bmatrix} 64/3 & -8 \\ -8 & 64 \end{bmatrix}$

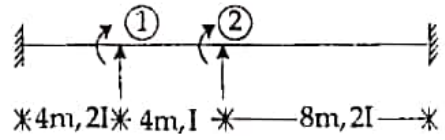
(2) $\frac{1}{E_1}\begin{bmatrix} 64/3 & 8 \\ 8 & -64/3 \end{bmatrix}$

(3) $\frac{1}{E_1}\begin{bmatrix} 64/3 & 8 \\ 8 & 4 \end{bmatrix}$

(4) $\frac{1}{E_1}\begin{bmatrix} 4 & -8 \\ -8 & 64/3 \end{bmatrix}$

---

37. Displacement coordinators for the beam are as shown in figure. The stiffness matrix is given by :



(1) $E_1\begin{bmatrix} 3 & 1 \\ 1 & 2 \end{bmatrix}$

(2) $E_1\begin{bmatrix} 3 & -0.5 \\ -0.5 & 2 \end{bmatrix}$

(3) $E_1\begin{bmatrix} 3 & 0 \\ 0 & 2 \end{bmatrix}$

(4) $E_1\begin{bmatrix} 3 & 0.5 \\ 0.5 & 2 \end{bmatrix}$

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38. A parabolic three hinged arch ABC is supporting Uniformly Distributed Load of 500 N/m over its entire span of 100 m. The center point 'B' is vertically 25 m high from supports A and C. The reactions shall be _____.

(1) 50 kN horizontal and vertical reactions at each support

(2) 25 kN horizontal and 50 kN vertical reaction at each support

(3) 50 kN horizontal and 25 kN vertical reaction at each support

(4) 25 kN horizontal and vertical reactions at each support

---

39. The stiffness matrix of a beam is given as :

$$K \times \begin{bmatrix} 12 & 4 \\ 4 & 5 \end{bmatrix}$$

Calculate the flexibility matrix.

Flexibility matrix will be _____.

(1) $\frac{K}{44}\begin{bmatrix} 12 & -4 \\ -4 & 5 \end{bmatrix}$ (2) $\frac{K}{44}\begin{bmatrix} 12 & 4 \\ 4 & 5 \end{bmatrix}$

(3) $\frac{1}{44\,K}\begin{bmatrix} 12 & -4 \\ -4 & 5 \end{bmatrix}$ (4) $\frac{1}{44\,K}\begin{bmatrix} 5 & -4 \\ -4 & 12 \end{bmatrix}$

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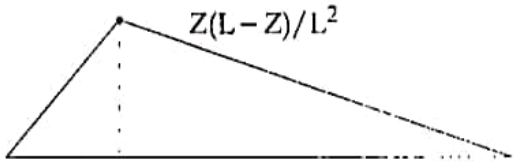
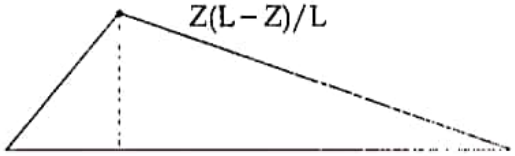
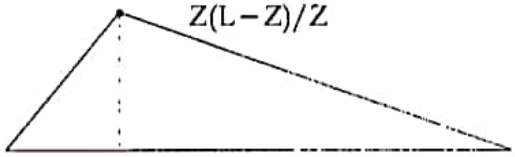
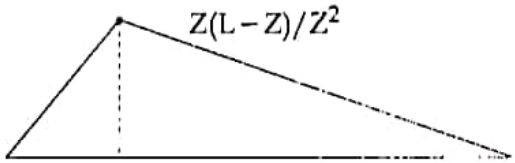
40. For a simply supported beam AB of span l. with point load W at point C, Z m from left support, ILD for bending moment at C (M_c) is :

(1)


(2)


(3)


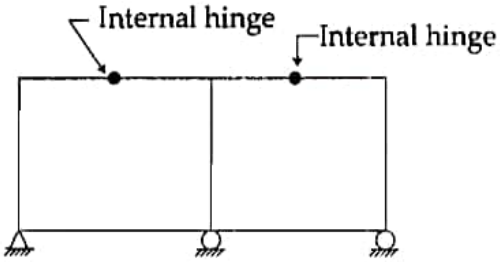
(4)


41. The cable and arch are subjected to axial forces respectively as, _____.

(1) Tensile and Compressive (2) Compressive and Tensile

(3) Tensile and Tensile (4) Compressive and Compressive

42. Degree of static indeterminancy for the frame shown below is



(1) 8 (2) 7 (3) 6 (4) 5

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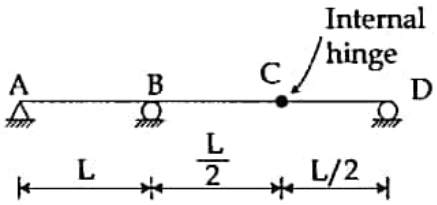
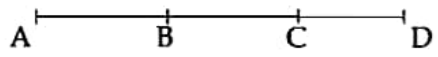
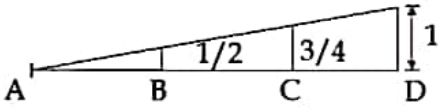
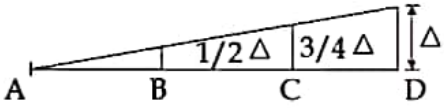
43. For the continuous beam shown in figure, the ILD for reaction at D is _____.



(1) 

(2)

(3) 

(4) 

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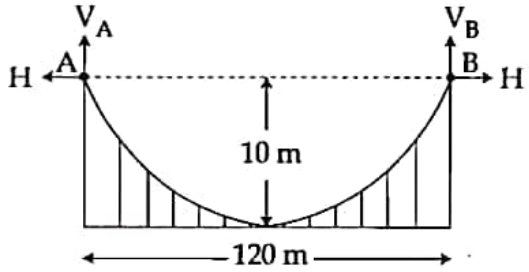
44. A cable of span 120 m and dip 10 m carries a load of 6 kN/m of horizontal span. The maximum tension in the cable is _____.



(1) 1238.42 kN (2) 1138.42 kN (3) 1038.42 kN (4) 1338.42 kN

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45. For simply supported beam of span 10 m, Influence line diagram is drawn for bending moment at a section 4 m from left hand support. The maximum bending moment at the section due to moving point load of 160 kN is equal to _____.

(1) 640 kN-m (2) 960 kN-m (3) 384 kN-m (4) 400 kN-m

46. Spot welding is used when two plates are placed :

(1) One below the other (2) One butting against the other

(3) One next to other (4) At right angles to each other

47. An angle section can be used as purlin when slope of the roof truss is :

(1) between 40° and 70° (2) less than 30°

(3) greater than 30° (4) less than 45°

48. The purpose of stiffness in a plate girder is to :

(1) Prevent buckling of web

(2) Increase moment carrying capacity of the girder

(3) Reduce the shear stress

(4) Take care of bearing stress

49. The anchor bolts are provided to check the :

(1) settlement of foundation (2) punching shear of base plate

(3) uplift of base plate (4) moment of base plate

50. The economical range of spacing of roof trusses is :

(1) $\frac{1}{2}$ to $\frac{1}{3}$ of span (2) $\frac{1}{2}$ to $\frac{1}{4}$ of span

(3) $\frac{1}{4}$ to $\frac{1}{6}$ of span (4) $\frac{1}{3}$ to $\frac{1}{5}$ of span

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51. The behaviour of a beam column cross section is expressed by which of the following relationship ?

(1) Moment - Curvature (2) Moment - Axial compression

(3) Axial compression - Curvature (4) Moment - Curvature - Axial compression

52. The plate used as a connecting piece at the intersection of two or more members in a roof truss is called as :

(1) Template (2) Gusset plate (3) Base plate (4) Shoe plate

53. The thickness of the base plate is determined from the :

(1) Flexural strength of the plate.

(2) Shear strength of the plate.

(3) Bearing strength of the concrete pedestal.

(4) Punching criteria.

54. The metal added at the joint while welding is known as _____.

(1) weld metal (2) filler

(3) fillet metal (4) all the above are correct

55. Which of the following statement is correct for reducing web buckling due to diagonal compression ?

(1) Not providing web stiffners to increase shear strength

(2) Providing web stiffner to reduce shear strength

(3) Increasing depth to thickness ratio

(4) Reducing depth to thickness ratio

56. The design shear stress for which of the following weld types is same as that for fillet welds ?

(1) Plug weld only (2) Slot weld only

(3) Plug and Slot weld only (4) Slot and Butt weld only

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57. A column c/s 300 mm × 400 mm, 2250 mm long fixed at one end and free at other end. The ratio of effective length to the least lateral dimension is :

(1) 7.5 (2) 15 (3) 11.25 (4) 9

58. In design of slab, as per IS-456, what should be minimum percent of distribution steel if Fe 415 reinforcement is used ?

(1) 0.12% of total cross section (2) 0.15% of total cross section

(3) 0.50% of total cross section (4) 1% of total cross section

59. What is the maximum diameter of main reinforcement used in the slab of overall thickness 160 mm as per IS 456-2000 ?

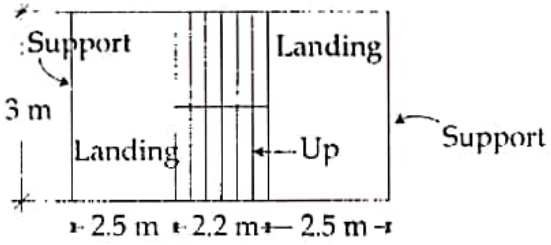
(1) 10 mm (2) 12 mm (3) 16 mm (4) 20 mm

60. For the design of staircase, self weight of waist slab is calculated as _____. Where, T = Tread, R = Riser and D = depth of waist slab, γ_c = density of R.C.C.

(1) $\gamma_c \cdot D$ (2) $\gamma_c \cdot D \cdot \left(\frac{T}{\sqrt{R^2 + T^2}} \right)$

(3) $\gamma_c \cdot \frac{\sqrt{T^2 + R^2}}{T}$ (4) $\gamma_c \cdot D \cdot \frac{\sqrt{T^2 + R^2}}{T}$

61. What is the effective span of staircase supported at each end by edge of the landing slab, which spans parallel, with the risers, if width of both landings is 2.5 m and going of stair is 2.2 m (see fig.) :



(1) 7.2 m (2) 4.7 m (3) 4.2 m (4) 2.2 m

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62. In the design of retaining wall, both, active earth pressure and passive earth pressure is considered due to soil available on both sides (with different heights) of R.C.C. retaining wall. If angle of repose, $\phi = 30°$, then what will be the relation between coefficient of active earth pressure (K_a) and passive earth pressure (K_p) ?

(1) $K_a = \frac{1}{3}K_p$ (2) $K_a = 3K_p$ (3) $K_a = 9K_p$ (4) $K_a = \frac{1}{9}K_p$

---

63. What is the effective span of staircase, supported at each end by landing spanning parallel with the risers, if the width of landing is 2.5 m, width of starting passage is 1.5 m and going of the stair is 2.2 m ?

(1) 6.2 m (2) 4.2 m (3) 3.95 m (4) 4.5 m

---

64. The minimum area of tension reinforcement shall be not less than _____ for design of beam.

(1) $\frac{0.87}{f_y}$ bD (2) $\frac{0.85}{f_y}$ bd (3) $\frac{0.67}{f_y}$ bD (4) $\frac{0.76}{f_y}$ bd

---

65. For high yield strength deformed bars of grade Fe 500, the permissible stress in direct tension and flexure tension shall be _____ used in working stress method.

(1) $0.87\, f_y$ (2) $0.67\, f_y$ (3) $0.55\, f_y$ (4) $0.48\, f_y$

---

66. If, in any given plane, one end of the column is unrestrained, its unsupported length 'l' shall not exceed _____. Where 'b' is width and 'D' is depth of cross section in plane under consideration.

(1) $\frac{100\ b}{D}$ (2) $\frac{100\ b^2}{D}$ (3) $\frac{100\ D}{b}$ (4) $\frac{100\ D^2}{b}$

---

67. If top of earth retained is horizontal, the coefficient of passive earth pressure for retaining wall become :

(1) $C\rho = \frac{1 - \sin\phi}{1 + \sin\phi}$ (2) $C\rho = \frac{1 + \sin\phi}{1 - \sin\phi}$

(3) $C\rho = \frac{\sin\phi - 1}{\sin\phi + 1}$ (4) $C\rho = \frac{\sin\phi + 1}{\sin\phi - 1}$

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68. A concrete beam is post-tensioned by a cable carrying an initial stress of 1000 N/mm^2, the slip at jacking end was observed to be 5 mm, modulus of steel is 210 kN/mm^2 and span of beam is 30 m; what is % of loss of stress due to anchorage ?

(1) 3.5% (2) 2.5% (3) 1.5% (4) 4.0%

69. The rate of increase of stress is large in case of :

(1) Bonded beams (2) Unbonded beams

(3) Tensioned beams (4) Anchorage beams

70. A simply supported prestressed concrete beam of span 10 m is subjected to a point load of 10 kN at centre. Prestressing force of 2000 kN is applied through inclined tendon, zero eccentricity at support and 'e' at mid-span. To nullify the external point load effect, how much 'e' should be provided ? Neglect the self weight of beam.

(1) 12.5 mm (2) 50 mm (3) 70 mm (4) 85 mm

71. In a prestressed concrete beam, the ratio of applied prestressing force (P) to the concrete capacity of the section in compression is known as

(1) Moment ratio (R) (2) Eccentricity Ratio (ϵ)

(3) Reinforcement Ratio (m) (4) Efficiency factor (ρ)

72. The minimum transverse reinforcement in prestressed concrete beam is given by formula :

(1) $\frac{b S_V}{A_{S_V}} = \frac{0.87 f_y}{0.4}$ (2) $\frac{A_{S_V}}{b S_V} = \frac{0.4}{0.87 f_y}$

(3) $\frac{A_{S_V}}{0.87 f_y} = \frac{0.4}{b S_V}$ (4) $\frac{b S_V}{0.87 f_y} = \frac{A_{S_V}}{0.4}$

73. The net downward force of pre-stressed concrete beam with bent tendon is given as :

(1) $w - 2p \sin\theta$ (2) $w + 2P \sin\theta$

(3) Zero (4) 2

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74. High tensile bars threaded at the ends are used in :

(1) Freyssinet system (2) Gifford - Udall system

(3) Lee - McCall system (4) Magnel - Blaton system

---

75. A post tensioned concrete beam is prestressed by means of three cables each 100 mm^2 area and stressed to 1100 MPa. All three cables are straight and located at an eccentricity of 50 mm. If modular ratio (m) = 6 and stress in concrete at the level of steel (f_c) = 5 MPa, then what is the loss of 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 MPa

---

76. 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) 55% (2) 69% (3) 76% (4) 85%

---

77. A system usually adopted in the production of pre-tensioned members like railway sleepers, poles, etc on large scale is _____.

(1) Magnel-Blaton system (2) P.S.C. Monowire system

(3) Hoyer system (4) Gifford-Udall system

---

78. On the areas immediately behind external anchorages, the permissible unit bearing stress on the concrete, after accounting for losses due to relaxation of steel, elastic shortening and seating of anchorages, shall not exceed _____.

(1) $0.48 f_{ci} \sqrt{\frac{A_{bearing}}{A_{punching}}}$ or $0.8 f_{cK}$ whichever is smaller

(2) $0.45 f_{ci} \sqrt{\frac{A_{bearing}}{A_{punching}}}$ or $0.40 f_{cK}$ whichever is smaller

(3) $0.48 f_{ci} \sqrt{\frac{A_{bearing}}{A_{punching}}}$ or $0.76 f_{cK}$ whichever is smaller

(4) $0.40 f_{ci} \sqrt{\frac{A_{bearing}}{A_{punching}}}$ or $0.78 f_{cK}$ whichever is smaller

---

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79. Independent float of an activity (i, j) is denoted by IF (i, j). The earliest occurrence times of i and j are denoted by E_i and E_j respectively. The latest occurrence times of i and j are denoted by L_i and L_j respectively. $D(i, j)$ indicates the duration of the activity. Select **correct** option giving IF (i, j) :

(1) $E_j - L_i - D(i, j)$ (2) $L_j - E_i - D(i, j)$

(3) $L_j - E_j - D(i, j)$ (4) $E_j - E_i$

---

80. A part of quality management system, that indicates the degree to which design quality is achieved in the actual construction work is called :

(1) Quality Assurance (2) Quality of design

(3) Quality of conformance (4) Quality of performance

---

81. Which among the following equipment found suitable for removing material from coffer dam, sewer manholes and well foundations ?

(1) Clamshell (2) Power shovel (3) Dragline (4) Back hoe

---

82. The following technique is not a quality control method ____ ____.

(1) Inspection (2) Testing (3) Designing (4) Sampling

---

83. The PERT is a management tool, having expected mean time (t_m), optimistic time (t_o) and persimistic time (t_p), where the variance is given by ____ ____.

(1) $\frac{t_p - t_o}{6}$ (2) $\frac{t_o + 4t_m + t_p}{6}$

(3) $(t_p - t_o)^2$ (4) $\left(\frac{t_p - t_o}{36}\right)^2$

---

84. When was the National Safety Council set up in India ?

(1) 1966 (2) 1867 (3) 1948 (4) 1962

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85. Items of 'C' type are identified for a project using ABC analysis. Which of the following statements are true for them ?

(a) Even rough quantity estimate is sufficient

(b) Bulk ordering is preferred

(c) Ordering on EOQ basis is preferred

(d) Even junior level staff is authorized to order

Answer Options :

(1) All of the above (2) (a), (b) and (d)

(3) Only (c) (4) None of the above

---

86. Which of the following is **not** a type of drilling equipment ?

(1) Jack Hammer (2) Shot drill (3) Drifter (4) Ripper

---

87. Which among the following construction equipment would you recommend for compaction of cohesive soil ?

(1) Smooth - Wheeled Rollers (2) Sheep Foot Rollers

(3) Vibratory Rollers (4) Tampers

---

88. A construction company has annual demand of 200 M.T. of steel. The annual cost of carrying per M.T. of steel is ₹ 2,000 and the cost to place an order is ₹ 50,000. What is the economic order quantity ?

(1) 50 M.T. (2) 70.7 M.T. (3) 100 M.T. (4) 40 M.T.

---

89. Which are some of the factors to be considered while designing site layout ?

(a) Construction sequence (b) Quantity of materials to be stored

(c) Parking of workers (d) Sanitary facilities

(e) Soil conditions

Answer Options :

(1) (a), (b), (c) and (d) (2) All of the above

(3) (a) and (b) (4) (a), (b) and (e)

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90. The convergence in the Bisection method is _____.

(1) non linear (2) limear (3) exponential (4) all of the above

---

91. The curve in a trapezoidal rule passing through the coordinates of a straight line has a polynomial of _____.

(1) First order (2) Second order (3) Third order (4) Fourth order

---

92. The Bisection method is also known as _____.

(1) Quaternary chopping (2) Tri-region chopping

(3) Binary chopping (4) Hex-region chopping

---

93. Newton - Raphson method has _____.

(1) first order convergence (2) second order convergence

(3) first order divergence (4) second order divergence

---

94. The value of $\int_{-3}^{3} x^4 \, dx$ by using Trapezoidal rule is :

(1) 112 (2) 114 (3) 113 (4) 115

---

95. A river is 80 metre wide. The depth 'd' in metres at a distance 'x' metres from one bank is given, by the following table :

x :	0	10	20	30	40	50	60	70	80
d :	0	4	7	9	12	15	14	8	3

Hence the area of c/s of the river using Simpson's rule is :

(1) 713 sq. met. (2) 710 sq. met. (3) 715 sq. met. (4) 716 sq. met.

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96. The quadratic equation $2x^2+3x+8=0$ is to be solved numerically starting with an initially value as $x_0=2$. The new estimate of x after the first iteration using Newton Raphson method is _____.

(1) 4 (2) 1 (3) 0 (4) -1

---

97. Bisection method is based on the repeated application of the _____ value property.

(1) intermediate (2) mediate (3) convergent (4) divergent

---

98. In Gauss Jordan method which of the following transformations are allowed :

(1) Diagonal transformations (2) Column transformations

(3) Row transformations (4) Square transformations

---

99. A cross-section area of river flow can be calculated by using following formula _____.

(1) Simpson's rule (2) Trapezoidal rule

(3) Both (1) and (2) (4) Thumb rule

---

100. Evaluate $\int_0^2 \frac{1}{2x+1}$ by using Trapezoidal rule. Take number of intervals = 2 (with each step = 1).

(1) 0.867 (2) 0.933 (3) 1.267 (4) 1.333

- o 0 o -

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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) मदर 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 प्रश्नाचं 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

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परीक्षेचे नांव : महाराष्ट्र स्थापत्य अभियांत्रिकी सेवा (मुख्य) परीक्षा-2019 परीक्षेचा दिनांक : 24 नोव्हेंबर, 2019

विषय : - स्थापत्य अभियांत्रिकी पेपर क्र. 1

महाराष्ट्र लोकसेवा आयोगामार्फत **" महाराष्ट्र स्थापत्य अभियांत्रिकी सेवा (मुख्य) परीक्षा-2019 (स्थापत्य अभियांत्रिकी पेपर क्र. 1)"** या स्पर्धा परीक्षेच्या प्रश्नपत्रिकेची प्रथम उत्तरतालिका उमेदवारांच्या माहितीसाठी संकेतस्थळावर प्रसिध्द करण्यात आली होती. त्यासंदर्भात उमेदवारांनी अधिप्रमाणित (Authentic) स्पष्टीकरण / संदर्भ देऊन पाठविलेली लेखी निवेदने, तसेच तज्ज्ञांचे अभिप्राय विचारात घेऊन, आयोगाने उत्तरतालिका सुधारित केली आहे. या उत्तरतालिकेतील उत्तरे अंतिम समजण्यात येतील. यासंदर्भात आलेली निवेदने विचारात घेतली जाणार नाहीत व त्याबाबत कोणताही पत्रव्यवहार केला जाणार नाही, याची कृपया नोंद घ्यावी.

उत्तरतालिका - KEY

प्रश्न क्रमांक	उत्तरे			
	संच A	संच B	संच C	संच D
1	1	2	3	3
2	2	3	2	2
3	3	2	3	3
4	2	3	2	3
5	4	3	3	3
6	1	2	1	1
7	3	4	2	2
8	3	2	4	2
9	3	2	2	2
10	2	1	2	2
11	2	3	3	1
12	2	1	1	4
13	#	2	#	1
14	4	4	1	4
15	4	1	4	2
16	2	#	2	2
17	2	4	2	1
18	1	1	4	#
19	2	1	1	4
20	1	2	4	1
21	4	4	4	4
22	1	4	2	2
23	4	2	1	4
24	4	3	1	1
25	3	4	4	2

प्रश्न क्रमांक	उत्तरे			
	संच A	संच B	संच C	संच D
26	1	3	3	1
27	3	4	2	4
28	4	1	1	4
29	1	2	4	3
30	2	3	3	1
31	3	1	1	3
32	1	4	1	4
33	4	1	3	3
34	1	1	4	1
35	1	4	3	4
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45	3	3	3	3
46	1	4	1	4
47	2	1	2	4
48	1	1	3	4
49	3	2	4	1
50	4	1	1	1

11th June, 2020

 # ने दर्शविलेले प्रश्न रद्द करण्यात आलेले आहेत.

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प्रश्न क्रमांक	उत्तरे			
	संच A	संच B	संच C	संच D
51	4	3	4	1
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54	#	4	4	#
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68	1	1	3	3
69	1	3	1	3
70	1	1	#	1
71	3	3	1	#
72	#	4	1	1
73	1	1	1	1
74	3	1	4	3
75	4	1	1	3

प्रश्न क्रमांक	उत्तरे			
	संच A	संच B	संच C	संच D
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83	#	1	1	#
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86	4	#	4	1
87	2	3	2	3
88	3	1	1	4
89	2	2	1	1
90	2	1	2	2
91	1	2	3	3
92	3	3	3	3
93	2	4	2	1
94	4	3	3	2
95	2	3	4	2
96	3	2	1	2
97	1	2	1	4
98	3	1	2	1
99	3	3	2	3
100	2	2	3	3

11th **June**, 2020

 # ने दर्शविलेले प्रश्न रद्द करण्यात आलेले आहेत.

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महाराष्ट्र स्थापत्य अभियांत्रिकी सेवा (मुख्य) परीक्षा- 2019
परीक्षा दि. 28/11/2019

A → संच क्रमांक

2019 **U13**

प्रश्नपुस्तिका क्रमांक
BOOKLET NO.

प्रश्नपुस्तिका - II

स्थापत्य अभियांत्रिकी पेपर - 2

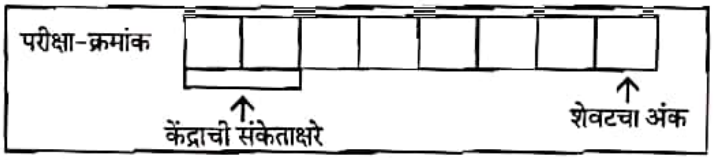
वेळ : 2 (दोन) तास

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.

(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''.**

पर्यवेक्षकांच्या सूचनेविना हे सील उघडू नये

ताकीद

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

पुढील सूचना प्रश्नपुस्तिकेच्या अंतिम पृष्ठावर पहा

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1. The areas enclosed by the contours in a lake are as follows :

Contour (m)	270	275	280	285	290
Area (m^2)	50	200	400	600	750

The volume of water between the contours 270 m and 290 m by trapezoidal formula is _____.

(1) 6400 m^3 (2) 8000 m^3 (3) 16000 m^3 (4) 24000 m^3

---

2. The R.L. of A is 98.75 m and the R.L. of B is 100.75 m. The horizontal distance between A and B is 10.0 m. If the contour interval is 0.25 m, the distance of 99.00 m contour line from A is _____.

(1) 0.25 m (2) 1.25 m (3) 2.0 m (4) 2.5 m

---

3. When the height of signal is not the same as that of the height of instrument, then a correction applied for measurement is known as :

(1) Curvature correction (2) Combined correction

(3) Axis signal correction (4) Refraction correction

---

4. If h is the height above datum of the object, H be the flying height above datum and r be the radial distance of the image of the object from principal point, then the relief displacement d is equal to :

(1) $d = \frac{r.h}{H}$ (2) $d = \frac{r.H}{h}$ (3) $d = \frac{H.h}{r}$ (4) $d = \frac{r}{H}$

---

5. In surveying optical square is used to setting out right angles. The horizon glass is placed at an angle of _____ with the horizon sight and index glass is placed at an angle of _____ with the index sight.

(1) 30° and 15° (2) 60° and 45° (3) 90° and 75° (4) 120° and 105°

---

6. If an upgrade of +1.4% joins another upgrade of +0.4% and rate of change of grade is 0.1% per 20 m chain, then the length of vertical curve is :

(1) 200 m (2) 360 m (3) 400 m (4) 80 m

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7. A rectangular plot of land of area 0.45 hectare is represented on a map by a similar rectangle of area 5 cm^2. Calculate R.F. of the scale of the map. Draw a scale to read upto a single metre from the map.

(1) 1 : 5000 (2) 1 : 8000 (3) 1 : 9000 (4) 1 : 3000

8. Two points A and B were fixed on opposite bank of a river. The level was setup near A and the staff readings on A and B were observed as 1.800 m and 1.300 m, respectively. Thereafter, level was setup near B and staff readings observed on B and A were found to be 0.350 m and 0.850 m, respectively. If the R.L. of A is 101.500 m, then R.L. of B is :

(1) 102.0 m (2) 101.0 m (3) 100.0 m (4) 100.450 m

9. The combined correction due to curvature and refraction in (m) for a distance of 2 kilometer is :

(1) 0.224 m (2) 0.1346 m (3) 0.1570 m (4) 0.1750 m

10. In tacheometric surveying :

(a) The intercept of the staff is maximum when the staff is normal to the line of sight.

(b) In the tangential system, the staff is kept normal to the line of sight.

(c) If a tacheometer is fitted with an anallatic lens, its additive constant is non zero.

(d) It is more convenient to hold the staff normal to the line of sight than to hold it vertical.

Select the **incorrect** statement/statements from the above.

(1) (a) only (2) (a) and (b) only

(3) (a), (b) and (c) only (4) (a), (b), (c) and (d) only

11. Generally how much amount is provided in estimate as work charged establishment ?

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

12. In rate analysis procedure, by what % the wet volume of concrete is to be increased for determining dry volume ?

(1) 20% (2) 30% (3) 52% (4) 25%

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13. Capitalised value of a property fetching a net annual rent of ₹ 1,000 and highest rate of interest prevailing being 10% will be :

(1) 1,000 (2) 1,00,000 (3) 10,000 (4) 100

14. In the Centre Line Method of calculating quantities, the following rules for each item from foundation is applied. The total centre line length of each item is calculated and for cross walls, deductions are made as follows :

(1) ½ breadth of item at each junction (2) 1 full breadth of item at each junction

(3) 2 full breadth of item at each junction (4) no deductions

15. Which value is obtained by dismantling the building ?

(1) Book Value (2) Distress Value (3) Salvage Value (4) Scrap Value

16. The sanction of detailed estimate design calculation, quantities of work, rates and cost of the work by competent authority is called as :

(1) Administrative approval (2) Technical sanction

(3) Expenditure sanction (4) Official sanction

17. Determine the capital sum to be invested to receive annual income of ₹ 1 lakh, if the rate of interest is 5%.

(1) ₹ 50 lakh (2) ₹ 20 lakh (3) ₹ 100 lakh (4) ₹ 10 lakh

18. Which of the following methods is also called as out to out and in to in method ?

(1) Long wall and short wall method (2) Centre line method

(3) Plinth area method (4) Cubic content method

19. Detailed specification for an item of P.C.C. (1 : 2 : 4) should include following points :

(1) Quantity of material, cost of different materials, work condition.

(2) General specification, materials to be used, quality and proportion, construction method, items to include/exclude, and mode of measurement and payment.

(3) Work conditions at site, BIS requirements, labour requirement and its cost.

(4) Sources of materials, instructions by PWD, labour requirement.

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20. A load of 625 T is imposed on a footing of size 2 m × 2 m.

If it is to be assumed that, stress at depth "d" is spread out at an angle of 2 vertical to 1 horizontal, find out the depth 'd' at which the intensity of stress will be $\left(\frac{1}{9}\right)^{th}$ of the stress at ground level.

Choose **correct** depth in metres from the following :

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

---

21. An embankment in clayey soil of 5 m height is to be constructed using factor of safety of 2.5. It is to be assumed that stability number is $\frac{1}{45}$ and unit weight of soil is 18 kN/m^3. Find the minimum cohesive strength (in kN/m^2) which the soil should have.

Choose **correct** answer from the following :

(1) 30 (2) 5 (3) 10 (4) 15

---

22. From the plate load test, the ultimate bearing capacity of plate of size 0.3 m × 0.3 m on sand deposit is observed to be 200 kN/m^2, the ultimate bearing capacity of a footing of size 1.5 m × 1.5 m will be :

(1) 200 kN/m^2 (2) 1000 kN/m^2 (3) 500 kN/m^2 (4) 2000 kN/m^2

---

23. In a rock core sampling method at site, the total length of drilling was 1.0 m in rocky strata. There were five intact pieces of rocks of lengths 150 mm, 200 mm, 75 mm, 50 mm, and 200 mm were collected. The value of Rock Quality Designation (RQD) for the rock sample is :

(1) 55.0% (2) 67.5% (3) 62.5% (4) 40.0%

---

24. Poisson's ratio of a soil sample is 0.4. Using theory of elasticity, the estimated value of the coefficient of lateral earth pressure at rest in the same soil is :

(1) 0.5 (2) 0.7 (3) 0.3 (4) 1.0

---

25. If a concentrated load Q produces a stress of 40 kN/m^2 at a depth of 1 m, then the stress at 2 m depth and same radial distance will be :

(1) 20 kN/m^2 (2) 80 kN/m^2 (3) 40 kN/m^2 (4) 10 kN/m^2

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26. Amount of compaction greatly affects :

(1) Water content and Maximum dry density

(2) Saturation of soil

(3) None of the above

(4) All of the above

---

27. A pile having a square cross-section of 0.5 m sides has length of 10 m. It is embedded in purely cohesive soil having uniform cohesion of 50 kN/sq. m upto 10 m depth. If adhesion factor = 0.5, the ultimate capacity of the pile considering only skin friction component will be :

(1) 500 kN (2) 125 kN (3) 250 kN (4) 200 kN

---

28. During unconfined compression test a soil sample failed at 150 N. The cross-sectional area of sample at failure was 2000 mm^2, then the shear strength of soil will be :

(1) 75 kN/m^2 (2) 375 kN/m^2 (3) 133 kN/m^2 (4) 37.5 kN/m^2

---

29. Two reservoirs are connected by two pipes M and N of identical diameter and length, in parallel. If the friction factor of M is 04 times that of N, the ratio of discharge in M to that of N is :

(1) 0.50 (2) 0.25 (3) 2.0 (4) 4.0

---

30. Bernoulli's equation is derived making assumptions that :

(1) The flow is uniform and incompressible.

(2) The flow is non-viscous, uniform and steady.

(3) The flow is steady, non-viscous, incompressible and irrotational.

(4) None of the above.

---

31. In a suppressed rectangular weir, the calculated discharge was found to be 3% in excess of the actual discharge. If this discrepancy was due to an error in reading the head, the measured head was :

(1) 3% excess (2) 2% less (3) 2% excess (4) 1.5% excess

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32. A uniform body 3 m long, 2 m wide and 1 m deep floats in water. If the depth of immersion is 0.60 m, then the weight of the body is :

(1) 3.53 kN (2) 33.5 kN (3) 35.31 kN (4) none of these

33. For a laminar flow through circular pipe, the maximum velocity is equal to _____.

(1) 1.5 times the average velocity (2) 2.0 times the average velocity

(3) 2.5 times the average velocity (4) None of the above

34. Coefficient of contraction is the ratio of :

(1) actual velocity of jet at Vena contracta to the theoretical velocity.

(2) loss of head in the orifice to the head of water available at the exit of the orifice.

(3) actual discharge through an orifice to the theoretical discharge.

(4) area of jet at Vena contracta to the area of orifice.

35. Model analysis of aeroplanes and projectile moving at supersonic speed is based on _____.

(1) Reynold Number (2) Froude Number

(3) Mach Number (4) Euler Number

36. A dimensionless group formed with variables :

ρ (mass density), μ (dynamic viscosity), g (gravitational acceleration) and D (characteristic length) is :

(1) $D^{3/2}/\rho\mu g$ (2) $\mu/\rho g^{1/2} D^{3/2}$ (3) $\mu/\rho g D^{3/2}$ (4) $\mu/\rho^{1/2} D g^{1/2}$

37. In a rectangular channel, carrying a certain discharge at a depth Y_o and Froude number F_o, then Y_c/Y_o=

(1) F_o (2) $F_o^{1/2}$ (3) $F_o^{3/2}$ (4) $F_o^{2/3}$

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38. In a reciprocating pump without air vessel, the friction head in the delivery pipe is maximum at the crank angle $\theta = ?$

(1) 0° (2) 90° (3) 135° (4) 180°

---

39. An air vessel in the delivery side of a reciprocating pump :

(1) maintains steady discharge output.

(2) prevents cavitation in the system.

(3) enables suction head to be increased.

(4) enables the pump to run at higher speed.

---

40. For double acting reciprocating pump, there will be no flow into or from the air valve, when the crank angle is :

(1) 39° 32' and 140° 28' (2) 39° 32 to 140° 28'

(3) 0° to 39° 32' (4) 18° 34' to 161° 26'

---

41. The specific speed of a centrifugal pump has the dimensions of :

(1) $L^{3/4} T^{-3/2}$ (2) $M^0 L^0 T^0$

(3) $M^{-1/2} L^{1/2} T^{-1/4}$ (4) $L^{3/4} T^{-1/2}$

---

42. The work saved by fitting an air vessel to a double acting reciprocating pump is :

(1) 39.2% (2) 84.8% (3) 48.8% (4) 92.3%

---

43. Match the pair :

(a)	Run of river plant	(i)	Large storage
(b)	Reservoir plant	(ii)	Water pumped back to the head water tank
(c)	Pumped storage plant	(iii)	Sea water
(d)	Tidal plant	(iv)	No storage

Answer Options :

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

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44. Kaplan turbine is a propeller turbine in which the vanes fixed on the hub are :

(1) non-adjustable (2) adjustable

(3) fixed (4) none of the above

45. The cylindrical bore diameter of a single acting reciprocating pump is 200 mm and its stroke is 400 mm. The pump runs at 60 rpm. The theoretical discharge for pump in litre per second is :

(1) 0.01256 (2) 12.56 (3) 1.256 (4) 0.1256

46. Which of the following statement is **correct** ?

(1) Centrifugal pump convert hydraulic energy into mechanical energy.

(2) Reciprocating pumps convert mechanical energy into hydraulic energy by means of centrifugal force.

(3) Centrifugal pumps convert mechanical energy into hydraulic energy by means of centrifugal force.

(4) Reciprocating pumps convert hydraulic energy into mechanical energy.

47. The design flood commonly adopted in India for spillways of major projects is the :

(1) Standard Project Flood. (2) Flood with a Return Period of 100 years.

(3) Probable Maximum Flood. (4) Flood with a Return Period of 10,000 years.

48. The Thiessen polygon is :

(1) a polygon obtained by joining adjoining raingauge station.

(2) a representative area used for weighing the observed station precipitation.

(3) an area used in the construction of depth-area curve.

(4) the descriptive term for the shape of hydrograph.

49. In a flow-mass curve study, the demand line drawn from a ridge in the curve did not intersect the mass curve again. This represents that :

(1) the reservoir was not full at the beginning.

(2) the storage was not adequate.

(3) the demand cannot be met by the inflow as the reservoir will not refill.

(4) the reservoir is wasting water by spill.

कच्च्या कामासाठी जागा/SPACE FOR ROUGH WORK

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50. An instantaneous unit hydrograph is a direct run-off hydrograph :

(1) of 1 cm magnitude due to a rainfall excess of 1 - h duration.

(2) that occurs instantaneously due to a unit rainfall excess of duration 'D' h.

(3) of unit rainfall excess precipitating instantaneously over the catchment.

(4) occurring at any instant in a long storm.

---

51. Evaporation losses from surface of a reservoir can be reduced by sprinkling :

(1) DDT (2) Acetyl alcohol

(3) Potassium permanganate (4) None of the above

---

52. Dalton's law is given as :

(1) $E_L = C[e_s + e_a]$ (2) $E_L = C[e_a - e_s]$

(3) $E_L = C[e_s - e_a]$ (4) $E_L = C[e_s + e_w]$

---

53. Direct run-off is made up of :

(1) Surface run-off, prompt interflow and channel precipitation.

(2) Surface run-off, infiltration and evapotranspiration.

(3) Overland flow only.

(4) Rainfall and Evaporation.

---

54. The Rainfall Intensity of Light Rain is :

(1) Upto 2.5 mm/Hz (2) Upto 3.0 mm/Hz

(3) Upto 5.00 mm/Hz (4) Upto 7.5 mm/Hz

---

55. A plot between rainfall intensity versus time is called as :

(1) hydrograph (2) mass curve (3) hyetograph (4) isohyet

---

56. Which of the following is known as 'feeding bottle technique' ?

(1) Drip Irrigation (2) Sprinkler Irrigation

(3) Furrow Method (4) None of the Above

कच्च्या कामासाठी जागा/SPACE FOR ROUGH WORK

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57. This type of dam requires strong abutment :

(1) Gravity (2) Buttress (3) Arch (4) All above

58. Given that the base period is 100 days and the duty of the canal is 1000 hectares per cumec, the depth of water will be :

(1) 0.864 cm (2) 8.64 cm (3) 86.4 cm (4) 864 cm

59. In Bligh Creep Theory [L/H] is called as :

(1) Creep Length (2) Hydraulic Gradient

(3) Coefficient of Creep (4) Percolation Coefficient

60. For the upstream face of an earthen dam, the most adverse condition for stability of slope is :

(1) sudden drawdown (2) steady seepage

(3) during construction (4) sloughing of slope

61. Mean Water Training means :

(1) Training for discharge (2) Training for depth

(3) Training for sediment (4) Training for flood

62. In spillway, when the tail water depth is less than the sequent depth and river bed is composed of stiff rock, which one of the following energy dissipation device is preferred ?

(1) Solid roller bucket (2) Slotted roller bucket

(3) Ski jump bucket (4) Stilling basin

63. The main cause of meandering is :

(1) presence of an excessive bed slope in the river.

(2) degradation.

(3) the extra turbulence generated by the excess of river sediment during floods.

(4) none of the above.

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64. Lacey gave V - Q - f relation as :

(1) $V = \left[\frac{Qf^2}{160}\right]^{1/4}$ (2) $V = \left[\frac{Qf^2}{140}\right]^{1/6}$

(3) $V = \left[\frac{fQ^2}{160}\right]^{1/4}$ (4) $V = \left[\frac{Qf}{140}\right]^{1/6}$

---

65. Which of the following method is recommended by I.R.C. for design of flexible pavement ?

(1) Group index method (2) Westergaard method

(3) CBR method (4) None of these

---

66. In case of pavement design :

Match the **List - I (Type of carriageway)** with **List - II (Lane distribution factor)** :

	List - I		**List - II**
(a)	Undivided roads with two lane carriageway	(i)	0.75
(b)	Undivided roads with single lane carriageway	(ii)	1.0
(c)	Divided carriageway with four lanes each	(iii)	0.45
(d)	Undivided roads with four lane carriageway	(iv)	0.40

Answer Options :

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

---

67. As per current Viscosity Graded (VG) bitumen specifications in India (IS 73 : 2006, Third revision) the Absolute Viscosity of bitumen using vacuum capillary tube viscometer is determined at _____ temperature.

(1) 135°C (2) 25°C (3) 27°C (4) 60°C

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68. The super-elevation is _____.

(1) directly proportional to the velocity of vehicles

(2) inversely proportional to the velocity of vehicles

(3) directly proportional to the width of pavement

(4) inversely proportional to the width of pavement

69. Match the pair :

(a)	Penetration test	(i)	Hardness property of stones
(b)	Plate bearing test	(ii)	Hardness or softness of bitumen
(c)	CBR test	(iii)	Penetration test for highway material
(d)	Abrasion test	(iv)	Modulus of subgrade reaction

Answer Options :

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

70. Which of the following statement is/are **correct** ?

(a) Penetration test on bitumen is carried out at 27°C.

(b) Ductility test on bitumen is carried out at 27°C.

(c) In softening point test on bitumen, rate of increase of temperature is 2°C per minute.

(d) The rate of pulling of standard briquette mould specimen in ductility test is 15 mm per minute.

Answer Options :

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

71. The free mean speed on a roadway is found to be 70 kmph. Under stopped condition the average spacing between vehicles is 5.0 m. The capacity flow is :

(1) 3500 vehicles/hour/lane (2) 3700 vehicles/hour/lane

(3) 3200 vehicles/hour/lane (4) 3000 vehicles/hour/lane

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72. If 'R' is the radius of curvature of a hill road, the maximum grade compensation (in percentage) is equal to :

(1) 65/R (2) 75/R (3) 85/R (4) 95/R

---

73. In a particular case, the design gradient is 1 in 25. If a horizontal curve of 100 m radius is to be introduced on this gradient, the compensated gradient on this curve is _____.

(1) 0.75% (2) 1.3% (3) 2.7% (4) 3.25%

---

74. In case of erection of multiple span truss bridges symmetrical about centre line, the erection is started from _____ until the centre is reached.

(1) Left end (2) Both ends

(3) Right end (4) None of the above

---

75. If the nature of river is at a moderate bent condition then maximum V depth of scour is taken as :

(1) 1.25 D (2) 1.75 D (3) 1.5 D (4) 2 D

---

76. The effective span for main girder in case of bridges is :

(1) the distance between centres of main girders.

(2) the distance between centres of cross girders.

(3) the distance between centres of road bearings.

(4) the distance between centres of bearing plates.

---

77. In which of the following type of Abutments, wing walls are not provided :

(1) Gravity Abutments (2) U - Abutments

(3) Tee - Abutments (4) Abutment Pier

---

78. While designing highway bridges, the wind load acting on any exposed moving live load will be assumed to act at a height of _____ above the roadway.

(1) 1.0 m (2) 1.2 m (3) 1.5 m (4) 1.75 m

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79. As per IRC recommendations the minimum straight length of approaches on either side of the bridge should be _____.

(1) 15 m (2) 20 m (3) 25 m (4) 30 m

80. For IRC Class A loading train, the nose to tail spacing between two successive trains shall not be less than _____.

(1) 12.5 m (2) 15.5 m (3) 17.5 m (4) 18.5 m

81. The width of carriageway is expressed in terms of traffic lanes, each lane meaning the width required to accommodate one train of _____ vehicles.

(1) Class A (2) Class B (3) Class C (4) Class 70 R

82. The effective linear waterway in meters is given by :

(1) $L = 0.75\ V^2$ (2) $L = C\sqrt{Q}$

(3) $L = 1.811\ C\sqrt{Q}$ (4) $L = CQ^2$

83. Which of the following is **not** a patented explosive available in the market for tunnelling operations ?

(1) PENT (2) RDX (3) TNT (4) NTT

84. Which shape of tunnel is suitable for the purpose of navigation ?

(1) Circular Shape (2) D Shape

(3) Horse-shoe Shape (4) Rectangular Shape

85. Which of the following method of tunnelling is being gradually replaced by compressed air tunnelling method ?

(1) Needle beam method (2) Belgian method

(3) Heading and Bench method (4) Forepoling method

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86. Which section of tunnel is also known as segmental root section tunnel ?

(1) D section (2) Egg Shaped Section

(3) Circular section (4) Rectangular Section

---

87. Which one of the following methods of tunnelling is used in hard rocks ?

(1) Fore poling method (2) Needle beam method

(3) Heading and Benching method (4) Shield tunnelling method

---

88. With reference to tunnelling which of the following factors, are to be considered for deciding the size of the shaft :

(1) System used for hoisting (2) Size of the muck car

(3) Quantity of muck to be lifted (4) Eventual use of the shaft

---

89. The tunnelling method that is not suitable in case of soft soil is :

(1) Needle beam method (2) Full face method

(3) Fore poling method (4) Liner plate method

---

90. The procedure of removal of rock protrusions by hammering immediately after the blasting is known as :

(1) Mucking (2) Skimming (3) Trimming (4) Scaling

---

91. Which one of the following Drift method is time consuming but provides good ventilation ?

(1) Top Drift Method (2) Bottom Drift Method

(3) Centre Drift Method (4) Side Drift Method

---

92. If the sewer is to be designed for the non-scouring velocity of 5 m/sec, which among the following material would you recommend ?

(1) Cast iron sewer (2) Glazed brick sewer

(3) Stone ware sewer (4) Cement concrete sewer

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93. Select the **incorrect** pair from the following pairs of treatment unit and impurities removed, in waste water treatment system :

(a) Grit chamber - Sand, silt

(b) Aeration tank - Suspended impurities

(c) Skimming tank - Fat and Grease

(d) Screen - Cloth, paper

Answer Options :

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

---

94. Carbon monoxide is considered as most poisonous gas in Urban areas because :

(1) It causes loss of sense of smell.

(2) It is carcinogenic in nature.

(3) It reduces oxygen carrying capacity of blood.

(4) It may cause conjunctivitis.

---

95. The ideal pathogenic indicator used for bacterial analysis of water is exhibited by the organism :

(1) Escherichia coli (2) Entamoeba histolytica

(3) Salmonella typhi (4) Vibro comma

---

96. In water treatment process, aeration of water is carried out to :

(1) remove hardness and chlorides from water.

(2) add calcium and magnesium to water.

(3) remove gases like carbon dioxide, hydrogen sulfide and to add oxygen to water.

(4) remove oxygen from water and to add carbon dioxide to impart test and odour to water.

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97. The unit in which both sedimentation and digestion take place simultaneously is the :

(1) Detritus tank (2) Imhoff tank

(3) Skimming tank (4) Clarifier

---

98. The sag in the dissolved oxygen curve results because of DO is a function of :

(1) Both addition and depletion of oxygen from the stream.

(2) The rate of addition of oxygen to the solution.

(3) The rate of addition of oxygen is linear, but not that of depletion.

(4) The rate of organic substances introduced in the process.

---

99. Alum as a coagulant is found to be effective between pH range of _____.

(1) 8.0 to 10.0 (2) 8.5 to 10.5 (3) 6.5 to 8.5 (4) 7.0 to 9.0

---

100. In an oxidation pond, the sewage is made non-putrescible primarily by :

(1) Algae bacteria symbiosis only.

(2) Bacterial oxidation only.

(3) Chemical oxidation only.

(4) Algae photosynthesis and algae bacteria symbiosis.

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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 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 प्रश्नक्रमांकासमोरील संबंधित वर्तुळ पूर्णपणे छायांकित करून दाखवावा. **ह्याकरिता फक्त काळ्या शाईचे बॉलपेन वापरावे, पेन्सिल वा शाईचे पेन वापरू नये.**

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परीक्षेचे नांव : महाराष्ट्र स्थापत्य अभियांत्रिकी सेवा (मुख्य) परीक्षा-2019 परीक्षेचा दिनांक : 24 नोव्हेंबर, 2019

विषय : - स्थापत्य अभियांत्रिकी पेपर क्र. 2

महाराष्ट्र लोकसेवा आयोगामार्फत **" महाराष्ट्र स्थापत्य अभियांत्रिकी सेवा (मुख्य) परीक्षा-2019 (स्थापत्य अभियांत्रिकी पेपर क्र. 2)"** या स्पर्धा परीक्षेच्या प्रश्नपत्रिकेची प्रथम उत्तरतालिका उमेदवारांच्या माहितीसाठी संकेतस्थळावर प्रसिध्द करण्यात आली होती. त्यासंदर्भात उमेदवारांनी अधिप्रमाणित (Authentic) स्पष्टीकरण / संदर्भ देऊन पाठविलेली लेखी निवेदने, तसेच तज्ज्ञांचे अभिप्राय विचारात घेऊन, आयोगाने उत्तरतालिका सुधारित केली आहे. या उत्तरतालिकेतील उत्तरे अंतिम समजण्यात येतील. यासंदर्भात आलेली निवेदने विचारात घेतली जाणार नाहीत व त्याबाबत कोणताही पत्रव्यवहार केला जाणार नाही, याची कृपया नोंद घ्यावी.

उत्तरतालिका - KEY

प्रश्न क्रमांक	उत्तरे			
	संच A	संच B	संच C	संच D
1	2	#	2	#
2	2	3	4	3
3	3	4	#	4
4	1	1	3	1
5	4	1	1	4
6	1	2	4	2
7	4	4	2	4
8	1	1	1	2
9	#	2	4	1
10	4	4	1	1
11	3	1	3	3
12	3	3	1	2
13	3	3	2	3
14	1	2	4	4
15	4	2	3	2
16	2	2	2	3
17	2	1	1	1
18	1	3	3	1
19	2	4	2	2
20	3	3	1	#
21	2	#	3	2
22	2	1	#	2
23	1	2	2	4
24	2	2	4	#
25	#	2	2	1

प्रश्न क्रमांक	उत्तरे			
	संच A	संच B	संच C	संच D
26	#	#	#	1
27	1	4	1	3
28	4	1	2	2
29	1	3	4	1
30	3	2	3	4
31	3	4	2	3
32	3	4	1	3
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34	4	3	3	2
35	3	3	3	4
36	2	3	3	2
37	4	1	4	3
38	2	2	3	1
39	1	1	1	2
40	1	1	3	1
41	1	3	1	3
42	1	2	2	1
43	3	3	1	1
44	2	1	2	2
45	2	1	2	3
46	3	2	1	2
47	3	1	3	3
48	2	3	1	3
49	3	3	1	3
50	3	3	3	2

11th June, 2020

 # ने दर्शविलेले प्रश्न रद्द करण्यात आलेले आहेत.

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प्रश्न क्रमांक	उत्त			
	संच A	संच B	संच C	संच D
51	4	3	2	1
52	3	3	3	1
53	1	2	4	4
54	1	4	3	3
55	3	1	3	3
56	1	3	2	2
57	#	1	#	3
58	3	#	1	#
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60	1	3	3	3
61	3	2	3	3
62	3	3	3	1
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66	2	1	2	1
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68	1	2	2	3
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72	2	4	1	4
73	4	3	3	2
74	2	2	4	3
75	3	3	2	4

प्रश्न क्रमांक	उत्तरे			
	संच A	संच B	संच C	संच D
76	4	3	1	1
77	3	1	4	1
78	3	4	3	4
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92	2	2	2	3
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94	3	3	1	1
95	1	3	1	2
96	3	4	3	4
97	2	4	3	4
98	1	1	2	2
99	3	1	4	3
100	4	3	4	3

11th **June**, 2020

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