महाराष्ट्र अभियांत्रिकी सेवा (स्थापत्य) अ (पूर्व) परीक्षा – 2013

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प्रश्नपुस्तिका क्रमांक
BOOKLET NO.

वेळ : 2 (दोन) तास

प्रश्नपुस्तिका
स्थापत्य अभियांत्रिकी

एकूण प्रश्न : 100
एकूण गुण : 100

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.**

परीक्षा-क्रमांक

↑   ↑
केंद्राची संकेताक्षरे   शेवटचा अंक

(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 करण्याच्या 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

कच्च्या कामासाठी जागा /SPACE FOR ROUGH WORK

1. Using the following data

x (feet)	0	10	20	30	40	50	60	70	80
d (feet)	0	4	y	9	12	15	14	8	3

by the simpson's $\frac{1}{3}$ rule, the area is 710 sq. feet. What is the value of y ?

(a) $y = 6.5$ (b) $y = 6$ (c) $y = 7.5$ (d) $y = 7$

Answer options :

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

2. At what values of λ and μ the system of equation $x + y + z = 6$, $x + 2y + 3z = 10$, $x + 2y + \lambda z = \mu$ has unique solution ?

(a) $\lambda = 3$, $\mu \neq 10$ (b) $\lambda \neq 3$, $\mu \neq 10$

(c) $\lambda \neq 3$, $\mu = 10$ (d) $\lambda = 3$, $\mu = 10$

Answer options :

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

3. $\dfrac{\partial(u, v)}{\partial(x, y)} \times \dfrac{\partial(x, y)}{\partial(u, v)} = ?$
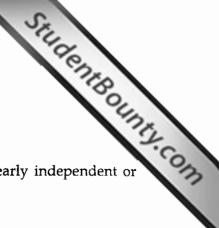
(a) -1 (b) 1 (c) zero (d) 2

Answer options :

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

4. The Particular integral of $(D^2 + 6D + 5)y = 4\, e^{-x}$ is equal to ?

(a) $4\, e^{-x}$ (b) $x\, e^{x}$ (c) $x\, e^{-x}$ (d) $4\, e^{x}$

Answer options :

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

5. If the scalar field $f = k^2 x^2 y - y^8$ and $\nabla^2 f$ at $(0, 1)$ is equal to zero. What is the value of k ?

(a) $0, 28$ (b) $28, 0$ (c) $2\sqrt{7}, -2\sqrt{7}$ (d) $28, -28$

Answer options :

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

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6. Whether the row vectors of the matrix $A = \begin{bmatrix} 1 & 2 & -2 \\ -1 & 3 & 0 \\ 0 & -2 & 1 \end{bmatrix}$ are linearly independent or dependent :

   (1) All row vectors are linearly dependent

   (2) All row vectors are linearly independent

   (3) Two rows are linearly independent

   (4) One row is linearly independent

7. What is the positive root of $x^4 - x = 10$ by Newton-Raphson method ?

   (1) 1.8533   (2) 1.8433   (3) 1.8555   (4) 1.8055

8. If $A = \begin{bmatrix} 2 & 0 \\ 0 & 1 \end{bmatrix}$, then A^{100} is :

   (1) $\begin{bmatrix} 2^{100} & 0 \\ 0 & 1 \end{bmatrix}$ (2) $\begin{bmatrix} 0 & 2^{100} \\ 0 & 1 \end{bmatrix}$ (3) $\begin{bmatrix} \infty & 2^{100} \\ 1 & 1 \end{bmatrix}$ (4) $\begin{bmatrix} 0 & 0 \\ 1 & 2^{100} \end{bmatrix}$

9. Ratio of the maximum bending stress in the flange to that in the web of an I section at any distance along the length of a beam is always :

   (1) Less than one   (2) Equal to one

   (3) More than one   (4) No relationship exists

10. Where does maximum shear stress occur in a rectangular shaft subjected to torsion ?

    (1) centre   (2) corners

    (3) middle of smaller side   (4) middle of longer side

11. A simply supported beam of span 'L' supports a concentrated load 'W' at mid-span. If the cross-section of beam is an I-Section, then the length of elastic-plastic zone of the plastic hinge will be :

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

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12. What is the greatest eccentricity which a load 'W' can have without producing tension the cross section of a short column of external diameter 'D' and internal diameter 'd'

(1) $\dfrac{D+d}{8\,D}$

(2) $\dfrac{\pi\,(D^4-d^4)}{32\,D^3}$

(3) $\dfrac{D^2+d^2}{8\,D}$

(4) $\dfrac{D^2-d^2}{8\,D}$

13. In LSM a balance beam section is defined as one in which :

(1) Both steel and concrete reach their maximum permissible stress simultaneously

(2) The stress in steel and concrete is same

(3) Both steel and concrete reach their maximum permissible strain simultaneously

(4) The beam section balances the load perfectly

14. As per IS : 800 – 2007., A bolt required to resist both design shear force (Vsd) and design tensile force (Tb) at the same time shall satisfy _____.

(1) $\left(\dfrac{Vsd}{Vdb}\right)^2 + \left(\dfrac{Tb}{Tdb}\right)^2 \le 1.0$

(2) $\left(\dfrac{Vsd}{Vdb}\right)^2 - \left(\dfrac{Tb}{Tdb}\right)^2 \le 1.0$

(3) $\left(\dfrac{Vsd}{Vdb}\right)^2 + \left(\dfrac{Tb}{Tdb}\right)^2 \ge 1.0$

(4) $\left(\dfrac{Vsd}{Vdb}\right)^2 - \left(\dfrac{Tb}{Tdb}\right)^2 \ge 1.0$

Where,   Vdb = design shear capacity

Tdb = design tension capacity

15. What is the strain energy stored in a rod of length 'L' and axial rigidity AE due to an axial force 'P' ?

(1) $\dfrac{P^2L}{AE}$

(2) $\dfrac{P^2L}{2\,AE}$

(3) $\dfrac{P^2L}{3\,AE}$

(4) $\dfrac{P^2L}{4\,AE}$

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16. Match **List-I** (Type of structure) with **List-II** (statical indeterminancy) and select the correct answer using the codes given below.

Where   m = no. of members

             j = no. of joints

             r = no. of reactions

List-I		**List-II**	
(a)	Rigid jointed plane frame	(i)	$(m+r)-3j$
(b)	Pin jointed space frame	(ii)	$(6m+r)-6j$
(c)	Rigid jointed space frame	(iii)	$(6m+r)-3j$
		(iv)	$(3m+r)-3j$

Codes :

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

17. What is the maximum admissible slenderness ratio of steel column subjected to **dead** and **live** load only ?

(1)   120   (2)   180   (3)   250   (4)   350

18. Which allowable stress governs the permissible bending capacity of a **structural section** ?

(1)   Bending compressive stress

(2)   Tensile stress

(3)   Bending tensile stress

(4)   Bending compressive or bending tensile stress

19. If a circular shaft is subjected to a torque 'T' and bending moment 'M', the ratio of maximum bending stress to maximum shear stress is _____.

(1) $\dfrac{2M}{T}$ (2) $\dfrac{M}{2T}$ (3) $\dfrac{M}{T}$ (4) $\dfrac{2T}{M}$

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20. What does a parabolic cable subjected to a uniformly distributed vertical load over the entire span, develop ?

    (1) Zero axial force
    (2) Large bending moment
    (3) Zero bending moment
    (4) Minor shear force

21. What do three hinges in an arch make it ?

    (1) Statically unstable structure
    (2) Statically determinate structure
    (3) Geometrically unstable structure
    (4) Indeterminate structure

22. Where is the bending stress on a beam section zero ?

    (1) Depends on the shape of the beam
    (2) Top fibre
    (3) Bottom fibre
    (4) Centroid of the section

23. What is the shape of influence line diagram for the maximum bending moment in a simply supported beam under udl ?

    (1) Rectangular   (2) Triangular   (3) Parabolic   (4) Circular

24. If f_{cu} and f_y are the cube compressive strengths, of concrete and yield stress of steel respectively and E_s is the modulus of elasticity of the steel for all grades of concrete, what can be taken as the ultimate flexural strain in concrete ?

    (1) 0.002   (2) $\dfrac{f_{cu}}{1000}$ (3) 0.0035   (4) $\dfrac{f_y}{1.15\,E_s} + 0.002$

25. The profile of the centroid of the tendon is parabolic with a central dip 'h', effective prestressing force 'p' and the length 'L'. What is the equivalent upward acting uniform load ?

    (1) $\dfrac{8hL}{p}$ (2) $\dfrac{8hp}{L^2}$ (3) $\dfrac{8\,h^2L}{p}$ (4) $\dfrac{8\,h^2p}{L}$

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26. In the limit state design, the maximum limit on redistribution of moments in statically indeterminate beam is :

    (1)   15%   (2)   25%   (3)   30%   (4)   10%

27. What should minimum width of lacing bar be if the 20 mm rivets are used in lacing bars ?

    (1)   40 mm   (2)   60 mm   (3)   80 mm   (4)   20 mm

28. What is Kanis method based on ?

    (1)   Moment Distribution method

    (2)   Column Analogy method

    (3)   Method of Consistent Deformation

    (4)   Strain Energy method

29. What will be the circumferential stress developed in case of thin cylindrical pipe with diameter 'd' and thickness 't', subjected to internal pressure 'p' ?

    (1) $\dfrac{pd}{4t}$ (2) $\dfrac{pd}{2t}$ (3) $\dfrac{p}{t}$ (4) $\dfrac{p}{2t}$

30. What can effectively counter balance uniformly distributed load on entire span on a prestressed concrete beam ?

    (1)   concentric cable   (2)   an eccentric cable

    (3)   a parabolic cable   (4)   none of the above

31. The ratio of the plastic moment capacity to the yield moment of a section is always :

    (1)   Less than one   (2)   Equal to one

    (3)   More than one   (4)   None of the above

32. What is the minimum percentage of reinforcement in R.C. Slab with (HYSD) bars ?

    (1)   0.12   (2)   0.15   (3)   0.20   (4)   0.25

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33. The partial safety factor applied to the reinforcement in the design of RC structures in the *limit state* of strength is :

    (1) 1.15 (2) 1.50 (3) 0.87 (4) Equal or less than 1.0

34. The flow net of earth dam gave the distance to the directrix from the focus as 5 m and coefficient of permeability of soil is 3×10^{-3} cm/s. What is the quantity of seepage per unit length of dam in m^3/s ?

    (1) 1.5×10^{-5} (2) 15×10^{-5} (3) 15×10^{-3} (4) 15×10^{-4}

35. A circular pile of 30 cm diameter and 7 m length passes through a recently filled up material of 3.5 m depth. The unconfined compressive strength of the soil is 60 kN/m^2. The -ve skin friction of the pile is :

    (1) 110 kN (2) 330 kN (3) 99 kN (4) 198 kN

36. Match the pairs for safe bearing capacity :

    (a) Moist clay which can be indented with strong thumb pressure   (i) 245 kN/m^2

    (b) Soft Rock   (ii) 150 kN/m^2

    (c) Medium sand, compact and dry   (iii) 100 kN/m^2

    (d) Fine sand, loose and dry   (iv) 440 kN/m^2

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

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37. Match the following :

(a)	Pneumatic tyre roller	(i)	Static compression
(b)	Sheep foot roller	(ii)	Eccentric weight rotation
(c)	Smooth wheel roller	(iii)	Kneading action
(d)	Vibratory roller	(iv)	Tamping and Kneading

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

38. What are the factors influencing cost of soil investigation ?

    (a) non uniformity of layers   (b) undisturbed sampling

    (c) depth of exploration   (d) nature of project

    Answer options :

    (1) (a) and (b)   (2) (b) and (c)   (3) (c) and (d)   (4) All the above

39. While carrying out stability of slopes, by using the method of slices, it was noticed that for a 10 m high slope, the length of circular arc was 30 m. The sum of shearing forces 500 kN and unconfined compressive strength of soil was 30 kN/m^2. Assuming unit weight of soil as 20 kN/m^3 what will be the factor of safety with respect to cohesion ?

    (1) 1.5   (2) 1.2   (3) 1.0   (4) 0.9

40. In which method of site exploration, soil and rock formations are broken by repeated blows of heavy chisel or bit suspended by a cable or drill rod ?

    (1) Rotary boring   (2) Percussion boring

    (3) Wash boring   (4) Auger boring

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41. Match **List - I** (giving method of estimation of pile capacity) with **List - II** (parameters be estimated), and select correct answer using codes given below :

	List - I		**List - II**
(a)	Dynamic formulae	(i)	Bearing capacity of cost in situ piles
(b)	Static formulae	(ii)	Separating end bearing and friction bearing capacity of pile
(c)	Pile load test	(iii)	Bearing capacity of timber pile
(d)	Cyclic pile load test	(iv)	Settlement of friction bearing pile

Codes :

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

42. Match **List - I** (type of foundation) with **List - II** (use of the foundation) select correct answer, using the codes given below :

	List - I		**List - II**
(a)	Floating piles	(i)	Closely spaced columns resting on compressible soil.
(b)	Micro piles	(ii)	Expansive soils
(c)	Combined footing	(iii)	Deep soft clays
(d)	Under-reamed piles	(iv)	Loose sands

Codes :

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

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43. Match **List - I** with **List - II** and select the correct answer using codes given below :

	List - I		List - II
	(Field Test)		**(Parameters measured)**
(a)	Plate Load Test	(i)	Total and frictional a resistance
(b)	Standard Penetration Test	(ii)	Load intensity and settlement values
(c)	Static Cone Penetration Test	(iii)	Ned values
(d)	Dynamic Cone Penetration Test	(iv)	SPT values

Codes :

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

44. If correct value of cohesion of highly soft clay is to be determined choose the correct type of test that should be carried :

(1) Direct shear test   (2) Triaxial shear test

(3) Field vane shear test   (4) Laboratory unconfined compression test

45. Match the following :

(a)	SM	(i)	Clay with intermediate plasticity
(b)	MH	(ii)	Poorly graded gravel
(c)	GP	(iii)	Silty sand
(d)	CI	(iv)	Silt of high compressibility

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

SPACE FOR ROUGH WORK

46. Match the following :

List - I	List - II
(Soil property)	(Range of soil property)
(a) Void ratio	(i) Always more than one
(b) Uniformity coefficient	(ii) Can be more than one
(c) Porosity	(iii) Always less than one

Answer options :

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

47. If back fill of a smooth backward vertical wall 6 m high carries a uniformly distributed load of 60 kN/m^2 and back fill soil has $\phi = 30°$, the active earth pressure due to uniform surcharge is :

(1) 160 kN/m^2 (2) 20 kN/m^2 (3) 216 kN/m^2 (4) 30 kN/m^2

48. Match the following :

(a) Plasticity Index   (i) $\dfrac{(w_l - w)}{I_p}$

(b) Consistency Index   (ii) $\dfrac{(w - w_p)}{I_p}$

(c) Liquidity Index   (iii) $\dfrac{(w_l - w_p)}{I_b}$

(d) Toughness Index   (iv) $(w_L - w_p)$

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

SPACE FOR ROUGH WORK

P.T.O.

49. Yield of a drainage basin is generally expressed as :

    (a) Total volume of water flowing per year

    (b) Total volume of water stored in a day

    (c) Total volume of water flowing per day

    (d) Discharge in a day

    Which of the above given statement, is/are correct ?

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

50. Hagen - Poiseuille equation for laminar flow in the circular pipes is given as :

    (a) $\dfrac{32\,\mu\,VL}{D^2}$ (b) $\dfrac{128\,\mu\,VL}{D^2}$ (c) $\dfrac{64\,\mu\,VL}{D^2}$ (d) $\dfrac{64\,\mu\,VL}{\pi D^2}$

    Which of the above given statements is correct ?

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

51. A streamline is a line :

    (1) Which is normal to the velocity vector at every point

    (2) Which represents lines of constant velocity potential

    (3) Which is normal to the lines of constant stream function

    (4) Which is tangental to the velocity vector everywhere at a given instant

52. The double mass curve technique is used for :

    (a) Determination of average annual rainfall

    (b) Determination of cumulative rainfall

    (c) Checking the inconsistency of a record of rainfall data

    (d) Measurement of effective rainfall

    Which of the above given statements is/are correct ?

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

    (3) (c) only   (4) (c) and (d) only

SPACE FOR ROUGH WORK

53. Match the following :

	List - I		List - II
(a)	Reynolds number	(i)	Inertia force and elastic force
(b)	Froude number	(ii)	Inertia force and surface tension
(c)	Weber number	(iii)	Inertia force and Gravity force
(d)	Mach number	(iv)	Inertia force and viscous force

Codes :

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

54. As per Lacey's theory, the silt factor is :

    (1) directly proportional to average particle size

    (2) inversely proportional to average particle size

    (3) directly proportional to square root of average particle size

    (4) not related to average particle size

55. When the pipes are connected in parallel, the total loss of head ?

    (1) is equal to the sum of the loss of head in each pipe

    (2) is same in each pipe

    (3) is equal to the reciprocal of the sum of loss of head in each pipe

    (4) none of the above

56. According to Lacey, the bed slope 'S' for a regime channel is given by :

    (1) $f^{4/3}/3340\ Q^{1/2}$ (2) $f^{2/3}/3340\ Q^{1/2}$

    (3) $f^{5/3}/3340\ Q^{1/6}$ (4) $f^{1/3}/3340\ Q^{1/6}$

SPACE FOR ROUGH WORK

P.T.O.

57. Levees are constructed :

    (1) Parallel to the river flow

    (2) Transverse to the river flow

    (3) At some inclination to the river flow

    (4) Sometimes parallel and sometimes transverse

58. If the R.L.S of canal bed level and high flood level of drainage are 212.0 m and 210.0 m respectively, then cross drainage work will be _____.

    (1) aqueduct   (2) superpassage   (3) syphon   (4) Syphon aqueduct

59. What is a drag force a function of ?

    (a) Projected area of the body

    (b) Mass density of the fluid

    (c) Velocity of the body

    The correct answer is.

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

60. The maximum elevation to which the water surface will rise in the reservoir during design flood is known as :

    (a) Full reservoir level

    (b) Maximum water level

    (c) Normal pool level

    (d) Full tank level

    Which of the above given statements is/are correct ?

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

61. What is the hydraulic radius 'R' equal to for a hydraulically efficient triangular channel with a depth of flow, 'y' ?

    (1) $2\sqrt{2}\, y$ (2) $\dfrac{y}{2}$ (3) $\sqrt{2}\, y$ (4) $\dfrac{y}{2\sqrt{2}}$

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

    (1) due to formation of a hydraulic jump

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

    (3) due to interaction of two complementary rollers

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

63. 0.5% of diluted raw sewage sample was used in a BOD test. The dissolved oxygen was found to be 8 mg/L and 5 mg/L at the beginning of BOD test and after 5 days of incubation at 20°C respectively. BOD_5 at 20°C of raw sewage is :

    (1) 150 mg/L   (2) 1500 mg/L   (3) 60 mg/L   (4) 600 mg/L

64. What is Dissolved Oxygen (DO) saturation level in fresh water at 0°C assuming that chloride concentration is zero (0 mg/lit) ?

    (1) 7.63 mg/lit   (2) 10.00 mg/lit   (3) 14.62 mg/lit   (4) 9.17 mg/lit

65. The sand used in rapid sand filter has effective size between :

    (1) 0.2 to 0.3 mm   (2) 0.8 to 0.95 mm

    (3) 0.1 to 0.20 mm   (4) 0.35 to 0.60 mm

66. Match **List - I** with **List - II** and select correct answer using codes given below the lists.

	List - I (Equipment)			**List - II** (Pollutant removed)
(a)	Bag house filter		(i)	Coarse particles
(b)	Electrostatic precipitator		(ii)	Fine dust
(c)	Adsorbers		(iii)	Sulphur Dioxide
(d)	Wet scrubber		(iv)	Gas

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

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P.T.O.

67. Which of the following factors affect disinfection process by chlorination ?

    (a) Form of chlorine

    (b) pH

    (c) Concentration

    (d) Contact time

    (e) Type of organism

    (f) Temperature

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

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

68. Match the following :

    (a) Dust particles　　　　(i) Death by asphyxiation

    (b) Hydrogen Fluoride　　(ii) Asthama

    (c) CO　　　　　　　　(iii) Mottling of teeth

    (d) Pollens　　　　　　(iv) Silicosis

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

69. Which of the following methods can be adopted for proper disposal of rubbish ?

    (1) Composting　　　　　　(2) Sanitary land fill

    (3) Incineration　　　　　　(4) Non-engineered land fill

70. Aerosol is a :

    (1) dispersion of small solids in liquid media

    (2) dispersion of small solids or liquid particles in gaseous media

    (3) finely divided particles of smoke

    (4) dispersion of liquid particles

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71. Match the following :

(a)	Gravitational settler	(i)	50-90% removal efficiency of P.M. (particulate matter)
(b)	Electrostatic precipitator	(ii)	> 99% removal efficiency of P.M.
(c)	Fabric Filtration	(iii)	< 50% removal efficiency of P.M.
(d)	Centrifugal collector	(iv)	95-99% removal efficiency of P.M.

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

72. The moisture content of raw sludge is 99% and it is thickened to 10 percent solids content. Then the :

   (1) volume of raw sludge is 1.1 times that of thickened sludge

   (2) volume of raw sludge is ten times that of thickened sludge

   (3) volume of raw sludge is nine times that of thickened sludge

   (4) volume of raw sludge is 9.9 times that of thickened sludge

73. Consider the following statements related to noise pollution :

   (a) Silence zone is 100 m distance from institutions, hospitals etc.

   (b) Sound beyond 80 dB harms human hearing system

   (c) Noise from automobiles is measured at 2 m free field distance

   Which of the above statements are correct ?

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

74. The liquid that perlocates through solid waste and extracts dissolved or suspended materials from it, is known as :

   (1) Sewage   (2) Sullage   (3) Waste water   (4) Leachate

75. Temporary hardness of water is also known as :

   (1) Carbonate hardness   (2) Non-carbonate hardness

   (3) Calcium sulphate hardness   (4) Magnesium chloride hardness

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P.T.O.

76. What is the Decibel (dB) value of sound during normal conversation ?

(1)   0 dB   (2)   20 dB   (3)   80 dB   (4)   60 dB

77. In sewage treatment, the horizontal flow grit chambers are designed to maintain a velocity very near to :

(1)   0.3 m/s   (2)   0.9 m/s   (3)   1.0 m/s   (4)   1.2 m/s

78. Group I contains parameters/property of bitumen and Group II lists methods/ Instrument :

Group I	Group II
(P) Softening point	(i) Pycnometer
(Q) Flash and Fire point	(ii) Pensky Martens closed cup
(R) Grading of Bitumen	(iii) Penetrometer
(S) Specific Gravity	(iv) Ring and Ball

The correct match of Group I with Group II is :

	(P)	(Q)	(R)	(S)
(1)	(i)	(ii)	(iii)	(iv)
(2)	(iv)	(iii)	(ii)	(i)
(3)	(iv)	(ii)	(iii)	(i)
(4)	(i)	(iii)	(ii)	(iv)

79. In a district where the rainfall is heavy, a state highway of cement concrete pavement, 7.0 m wide with a transverse slope of 2.0% is to be constructed. The height of the crown with respect to the edges is _____.

(1)   1.750 cm   (2)   17.500 cm   (3)   0.007 m   (4)   0.070 m

80. Two major roads with two lanes each are crossing in an urban area to form an uncontrolled intersection. With X as the number of conflict points when both roads are one way and Y when both roads are two-way what is the ratio of 'Y' to 'X' ?

(1)   3.0   (2)   2.0   (3)   1.0   (4)   4.0

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81. What is the frictional stress developed at the bottom of rigid pavement slab, in the winter season ?
   (1) Compressive stress
   (2) Tensile stress
   (3) Both Compressive and Tensile stress
   (4) None of the above

82. What is traffic density ?
   (1) No. of vehicles moving in specific direction per hour
   (2) No. of vehicles moving in specific direction per lane per day
   (3) No. of vehicles per unit length
   (4) No. of vehicles passing a given point in one hour

83. In an urban area, it is proposed to provide 90° angle parking. The available length of kerb is 1000 meter. How many parking spaces will there be available ?
   (1) 410   (2) 400   (3) 415   (4) 425

84. How many number of crossing conflict points are there on a right angled road intersection with two-way traffic ?
   (1) 04   (2) 08   (3) 16   (4) 24

85. Tentative Equivalency factor suggested by the I.R.C for bus, truck and agricultural tractor-trailer unit is _____.
   (1) 1.5   (2) 2.0   (3) 2.5   (4) 3.0

86. A compound curve consists of :
   (1) Proportionate super elevation   (2) Curves with different radius
   (3) Combined horizontal curves   (4) Two circular curves of different radii

87. If an equation is subtracted from a constant k, the weight of the resulting equation will be :
   (1) weight of equation divided by k
   (2) weight of equation multiplied by k
   (3) weight of equation multiplied by k^2
   (4) weight of equation remains unchanged

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88. In theodolite traverse computations, Gales table is useful for determination of :

    (1) Independent co-ordinates   (2) Dependent co-ordinates
    (3) Both (1) and (2)   (4) None of the above

89. The representative fraction (R.F) of scale 1 cm = 500 m is :

    (1) 1 : 500   (2) 1 : 5000   (3) 1 : 50000   (4) 1 : 50

90. The magnetic bearing of sun at noon was 170°. Hence magnetic declination is :

    (1) 10° E   (2) 10° W   (3) 10° S   (4) 10° N

91. A back sight reading on B.M = 200 m, was 2.250 m. The inverted staff reading to the bottom of a beam was 1.450 m. The R.L. of bottom of beam is :

    (1) 200. 800 m   (2) 201. 450 m   (3) 201. 000 m   (4) 203. 700 m

92. A tower is situated on the far side of the river and is inaccessible. But it is visible. It can be located by :

    (1) Radiation   (2) Traversing   (3) Intersection   (4) Resection

93. The ratio of tensile strength to compressive strength of concrete is about :

    (1) 1/5   (2) 1/10   (3) 1/2   (4) 1/20

94. At what height non-combustible material shall be used in construction of a building ?

    (1) 20 m above   (2) 15 m above   (3) 30 m above   (4) 25 m above

95. The minimum aggregate area of openings, excluding doors in residential buildings in wet hot climate shall not be less than :

    (1) $\frac{1}{10}$th of the floor area   (2) $\frac{1}{6}$th of the floor area

    (3) $\frac{1}{8}$th of the floor area   (4) $\frac{1}{12}$th of the floor area

96. What is the main constituent in fire proof paints ?

    (1) Aluminium powder   (2) Red lead
    (3) Copper powder   (4) Asbestos fibres

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97. A brick moulded with a rounded angle is called as :

    (1) Bull nose   (2) Horse nose   (3) Cow nose   (4) Donkey nose

98. The guidelines for Concrete Mix Design are covered in :

    (1) IS : 10262 – 1982   (2) IS : 14272 – 1985

    (3) IS : 10272 – 1983   (4) IS : 14273 – 1985

99. A rough estimate of the quantity of dynamite required in grams for blasting rocks is given by :

    (1) $L^2/0.008$ (2) $L^{2/3}/340$ (3) $L^2/500$ (4) $L/250$

100. Lean to Roof is suitable for the span :

    (1) upto 1.5 m   (2) upto 2.5 m   (3) upto 3.5 m   (4) upto 4.5 m

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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.**

कच्च्या कामासाठी जागा /SPACE FOR ROUGH WORK