Maharashtra Mechanical Engineering Services

Previous Year Paper

Main Examination

01 Oct 2022 Paper 2

'महाराष्ट्र राजपत्रित तांत्रिक सेवा (मुख्य) स्पर्धा परीक्षा-2021'
यांत्रिकी अभियांत्रिकी मुख्य परीक्षा

प्रश्नपुस्तिका क्रमांक 2021
BOOKLET No. परीक्षादि. 1 ऑक्टोबर, 2022

201633

प्रश्नपुस्तिका – II **C16** संच क्र. **A**

यांत्रिकी अभियांत्रिकी पेपर – 2

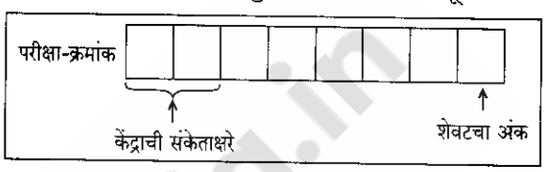
वेळ : 2 (दोन) तास

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. एकापेक्षा जास्त उत्तरे नमूद केल्यास ते उत्तर चुकीचे धरले जाईल व त्या चुकीच्या उत्तराचे गुण वजा केले जातील.

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

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

कच्च्या कामासाठी जागा / SPACE FOR ROUGH WORK

1. The number of degrees of freedom in a planar mechanism having n links and j simple hinge joints is
   (1) $3(n-3)-2j$ (2) $3(n-1)-2j$
   (3) $3n-2j$ (4) $2j-3n+4$

2. A Cam and Follower is an example of
   (1) Lower pair (2) Higher pair (3) Rolling pair (4) Spherical pair

3. At any instant, the Mechanical Advantage (MA) is the ratio of the
   (1) $\frac{\text{input torque}}{\text{output torque}}$ (2) $\frac{\text{input force}}{\text{output force}}$
   (3) $\frac{\text{output force}}{\text{input force}}$ (4) None of the above

4. Which of the following is an inversion of double slider crank chain ?
   (1) Whitworth quick return mechanism
   (2) Double crank mechanism
   (3) Pendulum pump
   (4) Oldham's coupling

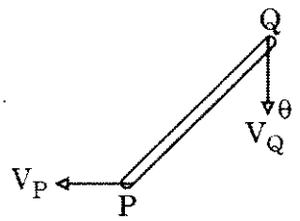
5. The transmission angle is maximum when the crank angle with the fixed link is
   (1) 270° (2) 180° (3) 135° (4) 225°

6. In a sliding motion, instantaneous centre lies at
   (1) pivoted joint (2) point of contact at the given instant
   (3) infinity (4) None of the above

7. For a link AB, which is rotating with 120 rpm and point 'B' on the link is located at a distance of 10 cm with respect to another point 'A' of the link. Linear velocity of point 'B' relative to 'A' is _____ m/s.
   (1) 4π (2) 2π (3) $0{\cdot}4\pi$ (4) 40π

8. In Klein's construction, acceleration diagram of slider crank mechanism on configuration diagram is
   (1) triangle (2) square
   (3) rectangle (4) quadrilateral

9. A rigid link PQ is undergoing plane motion as shown in the figure (V_P and V_Q are non-zero). V_{QP} is the relative of point Q with respect to point P. Which one of the following is True ?



(1) V_{QP} has components along and perpendicular to PQ.

(2) V_{QP} has only one component directed from P to Q.

(3) V_{QP} has only one component directed from Q to P.

(4) V_{QP} has only one component perpendicular to PQ.

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10. Which gear tooth system has shorter addendum and dedendum ?

(1) 14·5 degree full depth (2) 20 degree full depth

(3) 25 degree full depth (4) 20 degree stub

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11. For a critically damped system, motion is

(1) Non-oscillatory (2) Exponentially decreasing

(3) Oscillatory (4) Aperiodic

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12. The locus of a point on the circumference of circle that rolls without slipping inside the circumference of another circle is

(1) involute (2) cycloid

(3) epicycloid (4) hypocycloid

---

13. Angular acceleration of a link AB is given by

(1) $\frac{\text{Centripetal acceleration}}{\text{Length AB}}$ (2) $\frac{\text{Tangential acceleration}}{\text{Length AB}}$

(3) $\frac{\text{Total acceleration}}{\text{Length AB}}$ (4) $\frac{(\text{Tangential velocity of Point B})^2}{\text{Length AB}}$

कच्च्या कामासाठी जागा / SPACE FOR ROUGH WORK

14. The ratio of the difference between the maximum and minimum angular velocities of the crankshaft to its mean angular velocity is

(1) Coefficient of steadiness

(2) Coefficient of fluctuations of speed

(3) Coefficient of fluctuations of energy

(4) None of the above

15. The most suitable follower motion programme for high-speed follower motion is

(1) uniform acceleration and deceleration

(2) simple harmonic motion

(3) uniform velocity

(4) cycloidal

16. In balancing of several masses revolving in different planes

(1) resultant couple must be zero

(2) resultant force must be zero

(3) resultant force and couple must be zero

(4) None of the above

17. Determine gyroscopic couple effect on an aeroplane when engine rotates clockwise viewed from front and it takes left turn.

(1) Depress nose and raise tail

(2) Depress tail and raise nose

(3) No gyroscopic effect

(4) None of the above

18. The ratio of tight and slack side tensions in a V-belt or rope is

(1) $e^{\mu\theta} \sin \alpha$

(2) $e^{\mu\theta} \cos \alpha$

(3) $e^{\mu\theta}/\cos \alpha$

(4) $e^{\mu\theta}/\sin \alpha$

19. In a gear train, the train value is given by _____.

Let,

T_1 = Number of teeth on driving gear

T_n = Number of teeth on driven gear

(1) $\frac{T_1}{T_n}$ (2) $\frac{T_n}{T_1}$

(3) $T_1 \times T_n$ (4) $T_n - T_1$

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20. When two springs having stiffness k_1 and k_2 are connected in parallel, then equivalent stiffness is

(1) $k_1 + k_2$ (2) $k_1 - k_2$

(3) $\frac{1}{k_1} + \frac{1}{k_2}$ (4) $\frac{1}{k_1} - \frac{1}{k_2}$

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21. Large guns have dashpot with _____.

(1) under damping (2) critical damping

(3) over damping (4) None of the above

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22. In a spring mass system, if the mass is halved and spring stiffness is doubled, the natural frequency is

(1) halved (2) doubled

(3) unchanged (4) quadrupled

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23. When the frictional force helps the applied force in applying the brake, the brake is

(1) self-locking (2) automatic

(3) self-energising (4) None of the above

---

24. The amplitude of circular whirl at low speeds is determined by

(1) mass

(2) damping

(3) spring constant

(4) None of the above

---

25. The included angle for the 'V-Belt' is usually

(1) $60° - 80°$ (2) $40° - 60°$ (3) $30° - 40°$ (4) $20° - 30°$

26. In a close coiled Helical spring, the spring index is given by D/d where D = mean coil diameter and d = wire diameter. For considering the effect of curvature, the Wahl's factor 'k' is given by

(1) $\frac{4C-1}{4C-4} + \frac{0{\cdot}615}{C}$ (2) $\frac{4C-1}{4C+4} + \frac{0{\cdot}615}{C}$

(3) $\frac{4C+1}{4C-4} - \frac{0{\cdot}615}{C}$ (4) $\frac{4C+1}{4C+4} - \frac{0{\cdot}615}{C}$

27. What is/are the objectives of spring in series and parallel combinations ?

(1) To save the space
(2) To provide a fail-safe system
(3) To change the rate of the spring at a certain deflection
(4) All of the above

28. Check the following statements related to factor of safety :

Statement I : Factor of safety is the ratio of failure stress to allowable stress.

Statement II : Factor of safety is the ratio of failure load to working load.

Select the correct answer from the following :

Answer options :

(1) Only statement I is correct. (2) Only statement II is correct.
(3) Both statements are correct. (4) Both statements are wrong.

29. In a flat belt drive the belt can be subjected to maximum tension (T) and centrifugal tension (T_C). The condition for transmission of maximum power is given by _____.

(1) $T = 2\,T_C$ (2) $T = 3\,T_C$ (3) $T = \sqrt{3}\,T_C$ (4) $T = T_C$

30. The rate of helical compression spring (k) is given by _____.

If d = Wire diameter of spring
D = Mean coil diameter
G = Modulus of rigidity
N = Number of active coils

(1) $k = \frac{Gd^4}{8D^3N}$ (2) $k = \frac{GD^3}{8d^4N}$ (3) $k = \frac{D^3N}{8Gd^4}$ (4) $k = \frac{8Gd^4}{D^3N}$

कच्च्या कामासाठी जागा / SPACE FOR ROUGH WORK

31. The solid circular shaft is subjected to bending moment (M) and twisting moment (T). If the maximum bending stress is equal to maximum shear stress developed, then the bending moment (M) is equal to

(1) T (2) T/2 (3) 2T (4) 4T

32. If a shaft is subjected to combined bending moment (M_b) and twisting moment (M_t), then the equivalent twisting moment is given by

(1) $\sqrt{M_b^2 + M_t^2}$ (2) $M_b^2 + M_t^2$

(3) $\sqrt{M_b + M_t}$ (4) $M_b + \sqrt{M_b^2 + M_t^2}$

33. In ductile material, the magnitude of stresses are

(1) Ultimate = Yield = Elastic limit

(2) Ultimate > Yield > Elastic limit

(3) Ultimate > Yield = Elastic limit

(4) Ultimate < Yield < Elastic limit

34. Stress concentration factor is the ratio of

(1) Lowest value of actual stress near discontinuity to Nominal stress obtained by elementary equations for minimum cross-section.

(2) Highest value of actual stress near discontinuity to Nominal stress obtained by elementary equations for minimum cross-section.

(3) Nominal stress obtained by elementary equations for minimum cross-section to lowest value of actual stress near discontinuity.

(4) None of the above

35. The ratio of endurance limit of the notch-free specimen to endurance limits of the notched specimen is called

(1) Notch Sensitivity Factor (q)

(2) Theoretical Stress Concentration Factor (k_t)

(3) Fatigue Stress Concentration Factor (k_F)

(4) Endurance Factor (E)

कच्च्या कामासाठी जागा / SPACE FOR ROUGH WORK

36. A cottor joint is used to connect two rods which are subjected to _____.

(1) Tension (2) Compression

(3) Tension and compression (4) None of the above

37. A machine component is subjected to fluctuating stress that varies from 50 to 100. The corrected endurance stress limit for machine component is 250. The yield strength of material is 750. What is the suitable factor of safety using Soderberg line ?

(1) 5 (2) 4

(3) 3 (4) 2

38. In maximum shear stress theory, maximum shear stress is equal to

(1) allowable stress in tension (2) allowable stress in compression

(3) allowable stress in shear (4) None of the above

39. The Maximum normal stress theory is used for

(1) Ductile material (2) Brittle material

(3) Plastic material (4) Non-ferrous material

40. Maximum principal strain theory is also called as

(1) Guest's theory (2) St. Venant's theory

(3) Haigh's theory (4) Coulomb's theory

41. In case of helical compression spring, find mean coil diameter (D) if

d = Wire diameter of spring

D_i = Inside diameter of spring coil

D_o = Outside diameter of spring coil

(1) $\frac{D_o - D_i}{2}$ (2) $\frac{D_o + D_i}{2}$ (3) $\frac{D_o}{2}$ (4) $\frac{D_i}{2}$

42. Extrusion process is an example of which type of manufacturing process ?

(1) Casting process (2) Deformation process

(3) Material removal process (4) None of the above

कच्च्या कामासाठी जागा / SPACE FOR ROUGH WORK

43. The phase formed above the eutectoid temperature for carbon steels is known as _____.
(1) pearlite (2) austenite (3) ferrite (4) cementite

44. Inconel is an alloy of
(1) Nickel, chromium and iron (2) Nickel and copper
(3) Nickel and tin (4) Nickel and zinc

45. The process of achieving interparticle bonding of powders in a consolidated green body is known as _____.
(1) pressing (2) stress relieving
(3) sintering (4) compaction

46. Strain hardening is related to
(1) plastic deforming (2) increase in strength
(3) cold working (4) All of the above

47. The correct sequence of elements of 18-4-1 HSS tool is
(1) W, Cr, V (2) Mo, Cr, V
(3) Cr, Ni, C (4) Cu, Zn, Sn

48. Pearlite is a mixture of _____.
(1) ferrite and cementite (2) austenite and cementite
(3) cementite and ledeburite (4) ledeburite and ferrite

49. If carbon present in cast iron is mostly in the free state, it is known as
(1) white cast iron (2) grey cast iron
(3) molten cast iron (4) None of the above

50. The non-equilibrium phases of Fe-Fe_3C system are shown for their time and transformation on the _____ diagram.
(1) Fe-Fe_3C diagram (2) TTT diagram
(3) CCT diagram (4) CCT and TTT diagram

51. Fatigue life of a component can be increased by _____.
(1) introducing surface roughness (2) introducing compressive stresses
(3) subjecting them to tension (4) introducing shear stresses

52. The bright or white appearance of white cast iron is due to the presence of _____.
(1) cementite (2) ledeburite (3) martensite (4) pearlite

कच्च्या कामासाठी जागा / SPACE FOR ROUGH WORK

53. Of the following processes, which one is noted for highest material removal rates ?
(1) Electric discharge machining
(2) Electro chemical machining
(3) Electric discharge grinding
(4) Plasma arc cutting

54. Majority of the oxy-acetylene welding is done with _____.
(1) neutral flame
(2) reducing flame
(3) oxidising flame
(4) None of the above

55. The time period used for planning purposes in MRP (usually a week) is known as
(1) time bucket
(2) time phasing
(3) MRP time
(4) None of the above

56. In thermit welding, heat is generated _____.
(1) from the combustion of gas
(2) by an arc
(3) by chemical reaction between aluminum and iron oxide
(4) None of the above

57. Which one of the following cutting tool materials have higher hardness ?
(1) Alloy steel
(2) HSS
(3) Tungsten carbide
(4) Diamond

58. Blanking and punching operations can be performed simultaneously on
(1) combination die
(2) compound die
(3) progressive die
(4) simple die

59. The strength of brazed joint is typically _____ the filler metal out of which it is made.
(1) equal to
(2) stronger than
(3) weaker than
(4) None of the above

कच्च्या कामासाठी जागा / SPACE FOR ROUGH WORK

60. Enlarging an existing circular hole with a rotating single point tool is called _____.

(1) Boring (2) Drilling

(3) Reaming (4) Internal turning

61. Which of the following stress or strength parameters is used in the computation of rolling force ?

(1) Average flow stress

(2) Compression strength

(3) Final flow stress

(4) Tensile strength

62. In Electro-Chemical Machining (ECM), the material removal is due to _____.

(1) corrosion (2) erosion

(3) fusion (4) metallic ion exchange

63. Total solidification time is defined as which one of the following ?

(1) Time between pouring and complete solidification

(2) Time between pouring and cooling to room temperature

(3) Time between solidification and cooling to room temperature

(4) Time to give up the heat of fusion

64. A built-up-edge is formed while machining _____.

(1) ductile materials at high speed

(2) ductile materials at low speed

(3) brittle materials at high speed

(4) brittle materials at low speed

65. Which of the following operations is/are performed on a lathe machine ?

(1) Undercutting (2) Parting-off

(3) Reaming (4) All of the above

66. Brass and bronze are welded by _____.

(1) neutral flame (2) reducing flame

(3) oxidising flame (4) None of the above

कच्च्या कामासाठी जागा / SPACE FOR ROUGH WORK

67. Chipping of the tool may occur due to

a. tool material being too brittle

b. a crack that is already in the tool

c. excessive static loading of the tool

d. weak design of the tool

Answer options :

(1) Only a and b

(2) Only b and c

(3) Only a and c

(4) All a, b, c and d

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68. In a progressive die (sheet metal work), the tonnage of press can be reduced by _____.

(1) grinding the cutting edges sharp

(2) increasing the hardness of punches

(3) increasing the hardness of die

(4) staggering the punches

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69. Coining and gear forging are examples of _____.

(1) Open die forging

(2) Impression die forging

(3) Closed die forging

(4) Upset forging

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70. The primary purpose of sprue in the casting mould is to _____.

(1) feed the casting at a rate consistent with the rate of solidification

(2) act as a reservoir for molten metal

(3) feed molten metal from pouring basin to the gate

(4) help feed the casting until all solidification takes place

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71. Sensitivity of a measuring instrument is _____.

(1) the ratio of the scale spacing to the scale division value.

(2) the ratio of range of measurement to scale spacing.

(3) the scale division value.

(4) None of the above

72. Which of the following is correct if the 5° angle block is reversed and combined with the 45° angle block ?

(1) The resulting angle becomes 40°

(2) The resulting angle becomes 50°

(3) The resulting angle remains 45°

(4) Such a combination is not possible

73. In lapping process

(1) form tool is used

(2) the shape of the lap (tool) is imparted to the component

(3) there is an improvement in the surface quality of the part

(4) None of the above

74. An optical flat can be employed to measure height differences in the range of

(1) 0·01 – 0·1 mm

(2) 10 – 100 mm

(3) 1 – 10 mm

(4) 1 – 10 m

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75. Which gauge is used only for checking the size and condition of other gauges ?

(1) Workshop gauge

(2) Inspection gauge

(3) Purchase inspection gauge

(4) Master gauge

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76. In a hole and shaft pair designation of $60H_7/d_9$, the numbers 7 and 9 indicate

(1) accuracy of manufacturer

(2) tolerance grades

(3) case of assembly

(4) nothing of importance

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77. Two shafts A and B have their diameters specified as $100 \pm 0{\cdot}1$ mm and $0{\cdot}1 \pm 0{\cdot}0001$ mm respectively.

Which of the following statements is/are true ?

(1) Tolerance in the dimension is greater in shaft A.

(2) The relative error in the dimension is greater in shaft A.

(3) Tolerance in the dimension is greater in shaft B.

(4) The relative error in the dimension is greater in shaft B.

---

78. A part is said to be at the Maximum Material Condition (MMC) when

(1) its dimensions are at the limits that give the component the least amount of material.

(2) its dimensions are at the limits that give maximum amount of material in the part.

(3) its dimensions are at the zero deviation.

(4) None of the above

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79. A simply supported beam of length 'L' is loaded with distributed load of intensity zero at both ends and 'W' per unit length as center. What is the maximum bending moment in the beam ?

(1) $\frac{WL^2}{8}$ (2) $\frac{WL^2}{4}$ (3) WL^2 (4) $\frac{WL^2}{12}$

80. Continuous beam is one which has _____.

(1) less than two supports
(2) two supports only
(3) more than two supports
(4) None of the above

81. The deflection at the free end of a cantilever of length l carrying a point load W at its free end is given as _____.

(1) $-\frac{Wl}{2EI}$ (2) $-\frac{Wl^2}{2EI}$
(3) $-\frac{Wl^3}{2EI}$ (4) $-\frac{Wl^3}{3EI}$

82. A simply supported beam of length 'L' is subjected to uniformly varying load whose intensity varies from zero at left support and maximum at right support. What is the location of zero shear force ?

(1) $\frac{L}{\sqrt{3}}$ from left support (2) $\frac{L}{\sqrt{3}}$ from right support
(3) $\frac{L}{2}$ (4) $\frac{\sqrt{3}}{2}L$ from left support

83. A cube of side length 'a' is made up of material having Poisson's ratio 0·25. What will be the change in volume of cube under the action of load in only one direction ?

Take unit change in the dimension of cube in the direction of load.

(1) $1{\cdot}5\ a^2$ (2) $1{\cdot}5\ a^3$
(3) $0{\cdot}5\ a^2$ (4) $0{\cdot}5\ a^3$

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84. In a simply supported beam carrying a load whose intensity varies uniformly from zero at one end to w per unit run at the mid span, the maximum bending moment is equal to _____.

(1) $\frac{Wl^2}{4}$ (2) $\frac{Wl^2}{8}$ (3) $\frac{Wl^2}{12}$ (4) $\frac{Wl^2}{24}$

85. A circular shaft of length 'L' is subjected to torque 'T'. What is the total strain energy in the twisted shaft ?

Take G = Modulus of rigidity

I_P = Polar moment of inertia

(1) $\frac{T^2L}{2GI_P}$ (2) $\frac{T^2L}{GI_P}$ (3) $\frac{TL}{2GI_P}$ (4) $\frac{T^2}{2GI_PL}$

86. Strain energy absorbed due to sudden load is _____ the strain energy absorbed due to gradual load.

(1) two times (2) equal to

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

87. In thin shell, longitudinal stress (δ_L) is given by _____.

If p = Internal pressure

t = Thickness of cylinder

d = Internal diameter of cylinder

(1) $\frac{pd}{4t}$ (2) $\frac{pd}{8t}$ (3) $\frac{pd}{12t}$ (4) $\frac{pd}{6t}$

88. If the spherical and cylindrical thin vessels made of same material are of same diameters, subjected to same pressure, then which vessel is having smaller thickness ?

(1) Spherical

(2) Cylindrical

(3) Both have same thickness

(4) None of the above

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89. The ratio of Young's modulus to the modulus of rigidity for a material having Poisson's ratio 0·2 is given by

(1) 12/5 (2) 5/12 (3) 5/14 (4) 14/5

90. Which of the following are usually considered as thin cylinders ?

(1) Boilers (2) Tanks

(3) Steam pipes (4) All of the above

91. The strain energy stored in a simply supported beam of span 'L' and flexural rigidity 'EI' due to a central concentrated load 'W' is

(1) $\frac{W^2L^2}{48\,EI}$ (2) $\frac{W^2L^3}{48\,EI}$

(3) $\frac{W^2L^3}{96\,EI}$ (4) $\frac{W^2L^2}{96\,EI}$

92. Two solid shafts A and B are made of the same material. Diameter of A is twice the diameter of B. The ratio of strength of A to B in torsion is

(1) 2 (2) 4 (3) 8 (4) 16

93. Torsion equation for circular shaft is _____.

If τ = Shear stress

R = Radius of shaft

θ = The angle of twist in radian

C = Modulus of rigidity

l = Length of shaft

(1) $\frac{\tau}{R} = \frac{C\theta}{l}$ (2) $\frac{2\tau}{R} = \frac{C\theta}{l}$

(3) $\frac{\tau}{2R} = \frac{C\theta}{l}$ (4) $\frac{2\tau}{R} = \frac{C\theta}{2l}$

94. The shape of shear force diagram for cantilever beam carrying uniformly distributed load (u.d.l.) over its length is

(1) Rectangular (2) Triangular

(3) Parabola (4) Circular

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95. The point of contraflexure is also called _____.
(1) the point of inflexion
(2) a virtual hinge
(3) Either of the above
(4) None of the above

96. If for a given material 'E' is Young's modulus and 'G' is modulus of rigidity, then what is ratio of 'E' and 'G', if Poisson's ratio is 0·35 ?
(1) 1·35
(2) 2·7
(3) 2
(4) 3·75

97. Modulus of rigidity is defined as the ratio of _____.
(1) shear stress to shear strain
(2) linear stress to linear strain
(3) linear strain to lateral strain
(4) lateral strain to linear strain

98. Poisson's ratio is a ratio of
(1) Modulus of elasticity and modulus of rigidity
(2) Stress and strain
(3) Lateral strain and linear strain
(4) None of the above

99. A thin cylinderal shell of diameter 'd', wall thickness 't' is subjected to an internal fluid pressure 'P'. If 'E' is Young's modulus and $\frac{1}{m}$ is Poisson's ratio for cylinder material, which of the following expressions give volumetric strain of cylinder ?
(1) $\frac{Pd}{2tE}\left(2{\cdot}5 - \frac{2}{m}\right)$
(2) $\frac{Pd}{2tE}\left(5 - \frac{2}{m}\right)$
(3) $\frac{Pd}{3tE}\left(5 - \frac{2}{m}\right)$
(4) $\frac{Pd}{3tE}\left(2{\cdot}5 - \frac{2}{m}\right)$

100. The slope and deflection at a section in a loaded beam can be found out by which of the following methods ?
(1) Double Integration Method
(2) Moment Area Method
(3) Macaulay's Method
(4) Any of the above

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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 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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