सहायक मोटार वाहन निरीक्षक परीक्षा -२०१३

प्रश्नपुस्तिका क्रमांक
BOOKLET No.

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A

प्रश्नपुस्तिका

यंत्र अभियांत्रिकी स्वयंचल अभियांत्रिकी/ यंत्र अभियांत्रिकी/स्वयंचल अभियांत्रिकी

एकूण प्रश्न : [redacted]

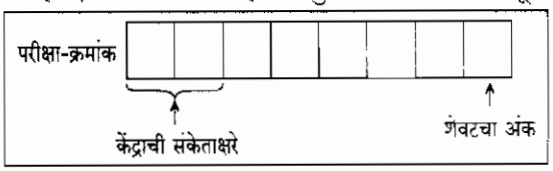
वेळ : $1\frac{1}{2}$ (दीड) तास

एकूण गुण : [redacted] 300

सूचना

(1) सदर प्रश्नपुस्तिकेत **150** 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''.**

विशेष सूचना :

सदर प्रश्नपत्रिका विभाग – 'अ', 'ब', 'क' विभागांमध्ये विभागण्यात आली आहे. त्यापैकी 'विभाग – अ – Mechanical Engineering – Automobile Engineering' मधील प्रश्न (प्र.क्र. 1 – 120) हे अनिवार्य आहेत. तर 'विभाग – ब – Mechanical Engineering' (प्र.क्र. 121 – 150) किंवा 'विभाग – क – Automobile Engineering' (प्र.क्र. 151 – 180) यापैकी एकाच विभागातील प्रश्न सोडविणे बंधनकारक आहे', याची कृपया उमेदवारांनी नोंद घ्यावी.

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

कच्च्या कामासाठी जागा / SPACE FOR ROUGH WORK

PART A (विभाग अ)

MECHANICAL ENGINEERING — AUTOMOBILE ENGINEERING

1. The principal stresses at a point in a two-dimensional stress system are σ_1, σ_2 and corresponding principal strains are ε_1, ε_2. If E and μ denote Young's modulus and Poisson's ratio, then which one of the following is correct ?

(1) $\sigma_1 = EG$

(2) $\sigma_1 = \dfrac{E}{1-\mu^2}\,[\varepsilon_1 + \mu\varepsilon_2]$

(3) $\sigma_1 = \dfrac{E}{1-\mu^2}\,[\varepsilon_1 - \mu\varepsilon_2]$

(4) $\sigma_1 = E\,[\varepsilon_1 - \mu\varepsilon_2]$

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2. What is the relationship between the linear elastic properties — Young's modulus (E), rigidity modulus (G) and bulk modulus (K) ?

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

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

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

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

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3. What is the strain energy stored in a body of volume V with stress σ due to gradually applied load ?

(1) $\dfrac{\sigma E}{V}$

(2) $\dfrac{\sigma E^2}{V}$

(3) $\dfrac{\sigma V^2}{E}$

(4) $\dfrac{\sigma^2 V}{2E}$

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4. In a Mohr's circle, the radius of circle is taken as

(1) $\sqrt{\left(\dfrac{\sigma_x - \sigma_y}{2}\right)^2 + (\tau_{xy})^2}$

(2) $\sqrt{\left(\dfrac{\sigma_x + \sigma_y}{2}\right)^2 + (\tau_{xy})^2}$

(3) $\sqrt{\left(\dfrac{\sigma_x - \sigma_y}{2}\right)^2 - (\tau_{xy})^2}$

(4) $\sqrt{(\sigma_x - \sigma_y)^2 + (\tau_{xy})^2}$

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5. Which one of the following expresses the total elongation of a bar of length L, constant cross-section of A and modulus of elasticity E, hanging vertically and subjected to its own weight, W ?

(1) $\frac{WL}{AE}$ (2) $\frac{WL}{2AE}$ (3) $\frac{2WL}{AE}$ (4) $\frac{WL}{4AE}$

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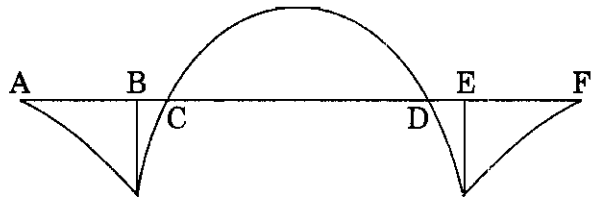
6. The bending moment diagram for an overhanging beam is shown in figure. The points of contraflexure would include



(1) A and F (2) B and E (3) C and D (4) A and D

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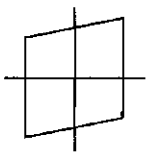
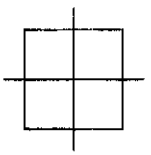
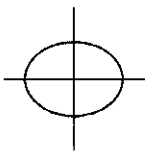
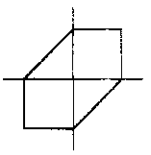
7. Which of the following represents maximum shear stress theory ?

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

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8. Given a simply supported beam of length 'L' subjected to uniform varying load whose intensity is zero at left support and 'W' at right support. Then maximum bending moment is equal to

(1) $\frac{WL^2}{7\sqrt{3}}$ (2) $\frac{WL^2}{9\sqrt{3}}$ (3) $\frac{WL^3}{9\sqrt{3}}$ (4) $\frac{WL^2}{2\sqrt{3}}$

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9. The design of thin cylinder is based on

(1) internal pressure (2) diameter of cylinder

(3) longitudinal stress (4) All of these

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10. The intensity of shear stress at any point in the cross-section of shaft subjected to pure torsion is _____ its distance from the centre.

(1) directly proportional to (2) not proportional to

(3) inversely proportional to (4) None of the above

SPACE FOR ROUGH WORK

11. Equivalent length of column with both ends fixed is equal to

(1) Length of column

(2) $2 \times$ length of column

(3) Length of column divided by two

(4) None of the above

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12. The maximum stress intensity at the base of square column of area 'A' and side 'b' subjected to load 'W' at an eccentricity 'e' equals to

(1) $\frac{W}{A}\left(1 + \frac{2e}{b}\right)$ (2) $\frac{W}{A}\left(1 - \frac{4e}{b}\right)$

(3) $\frac{W}{A}\left(1 + \frac{6e}{b}\right)$ (4) $\frac{W}{A}\left(1 + \frac{8e}{b}\right)$

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13. Given a simply supported beam 'L' mm length subjected to central point load 'W' N. Moment of inertia of beam section is 'I' mm^4 and modulus of elasticity of beam material is 'E' MPa. Maximum deflection in beam is

(1) $\frac{WL^2}{16\,EI}$ (2) $\frac{WL^3}{16\,EI}$ (3) $\frac{WL^3}{24\,EI}$ (4) $\frac{WL^3}{48\,EI}$

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14. Moment of inertia of triangular section having base 80 mm and height 60 mm about axis passing through CG and parallel to base is

(1) 15×10^6 mm^4 (2) 20×10^6 mm^4

(3) 480×10^3 mm^4 (4) 1440×10^3 mm^4

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15. When a body is subjected to a direct stress 'σ' in one plane and shear stress 'τ', the maximum normal stress is

(1) $\frac{\sigma}{2} + \frac{1}{2}\sqrt{\sigma^2 + 4\tau^2}$ (2) $\frac{\sigma}{2} - \frac{1}{2}\sqrt{\sigma^2 + 4\tau^2}$

(3) $\frac{\sigma}{2} + \frac{1}{2}\sqrt{\sigma^2 - 4\tau^2}$ (4) $\frac{\sigma}{2} - \frac{1}{2}\sqrt{\sigma^2 - 4\tau^2}$

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16. Mild steel belongs to the category of

(1) No carbon steel (2) Low carbon steel

(3) Medium carbon steel (4) High carbon steel

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17. Atomic packing factor for Face Centred Cubic (FCC) structure is

(1) 0·74 (2) 0·52 (3) 0·68 (4) 0·64

18. For successful extrusion, the metal should be

(1) Ductile (2) Malleable (3) Plastic (4) Tough

19. The amount of pearlite and cementite in transformed ledeburite at room temperature according to lever rule is

(1) 20·4 and 79·6% respectively (2) 30·4 and 69·6% respectively

(3) 50·4 and 49·6% respectively (4) 40·4 and 59·6% respectively

20. Which amongst the following does ***not*** represent an oblique cutting process ?

(1) Milling cutter (2) Drills

(3) Planer (4) Broaching

21. A high speed tool steel is used for machining of a workpiece of mild steel. While machining at cutting speed of 30 m/min., the useful tool life of tool steel is found to be 1 hr. What will be the tool life if the same tool is used to cut at a speed of 40 m/min. ? (Assume n = 0·12)

(1) 5 min. (2) 5·75 min. (3) 6 min. (4) 5·5 min.

22. Which of the following methods should be used for turning internal tapers only ?

(1) Tail stock offset (2) Taper attachment

(3) Form tool (4) Compound rest

23. Gearing ratio used for thread cutting on lathe machine is the ratio of

(1) Speed of lead screw to speed of workpiece

(2) Speed of workpiece to speed of lead screw

(3) Lead of lead screw threads to lead of screw to be cut

(4) Driven to driver

SPACE FOR ROUGH WORK

24. A hollow workpiece of 60 mm outside diameter and 150 mm length is held on a mandrel between centres and turned all over in 4 passes. If the approach length = 20 mm, over travel = 12 mm, average feed = 0·8 mm/rev., cutting speed = 30 m/min., then the machining time is

(1) 7·52 min. (2) 6·27 min. (3) 2·52 min. (4) 5·72 min.

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25. Horizontal boring machines can be used to

(1) Drill the holes (2) Bore the holes

(3) Ream the holes (4) All of the above

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26. In crank and slotted link mechanism, the forward and return stroke angles used are

(1) 220° and 140° respectively (2) 140° and 220° respectively

(3) 180° each (4) 200° and 160° respectively

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27. Feed rate in automatic table feed mechanism used in shaping machine increases with

(1) decrease in distance between the disc centre and the centre of adjustable pin

(2) increase in diameter of disc

(3) increase in distance between the disc centre and the centre of adjustable pin

(4) decrease in diameter of bull gear

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28. The lapping operation is done to

(1) produce geometrically true surface

(2) correct minor imperfections in shape

(3) secure a fine surface finish

(4) All of the above

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29. Straddle milling is used for

(1) machining a flat surface at an angle

(2) machining two parallel vertical surfaces of a workpiece simultaneously

(3) machining multiple parallel vertical surfaces of a workpiece

(4) machining of T-slots on workpiece

SPACE FOR ROUGH WORK P.T.O.

30. Which bond is used in grinding wheels for very high class surface finish wit dimensional accuracy ?

(1) Rubber bond (2) Vitrified bond

(3) Silicate bond (4) Oxychloride bond

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31. Module of a gear is the

(1) ratio of pitch circle diameter to the number of teeth

(2) ratio of number of teeth to pitch circle diameter

(3) reciprocal of pitch circle diameter

(4) product of pitch circle diameter and number of teeth

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32. In broach geometry, to curl and escape the chips

(1) Clearance angle is provided

(2) Land is provided

(3) Tooth gullet is provided

(4) Hook radius is provided

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33. Finishing of gear is performed using

I. Gear hob

II. Gear shaper

III. Gear shaving tool

IV. Gear lapping

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

(3) III and IV only (4) II and IV only

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34. Ultrasonic machining (USM) is a kind of

(1) Grinding method (2) Lapping method

(3) Honing method (4) Buffing method

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35. Chemical machining has the following advantages :

I. Low tooling cost

II. Parts produced are free from burr

III. Hard and brittle materials can be machined

IV. Material removal rate is high

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

(3) I and IV only (4) I and II only

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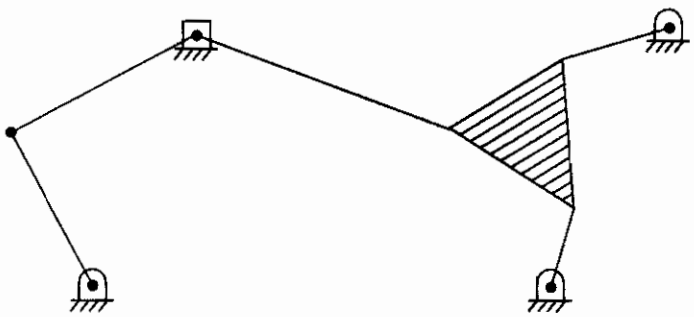
36. The degrees of freedom of a five link plane mechanism with five revolute pairs as shown in figure is



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

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37. Which of the following is the inversion of double slider crank chain ?

(1) Beam engine

(2) Elliptical trammel

(3) Watt's indicator mechanism

(4) Quick return motion mechanism

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38. When crank rotates with uniform speed it has

(1) only radial acceleration (2) only tangential acceleration

(3) only Coriolis acceleration (4) None of the above

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39. Which of the following is transmission dynamometer ?

(1) Rope brake (2) Electric generator

(3) Prony brake (4) None of the above

SPACE FOR ROUGH WORK P.T.O.

40. Klein's construction is mainly used to

(1) determine the linear velocity of piston

(2) determine the linear acceleration of piston

(3) determine the linear displacement of piston

(4) None of the above

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41. Frictional force is more in

(1) dry sliding friction (2) dry rolling friction

(3) non-viscous friction (4) viscous friction

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42. Which one of the following statements is ***not*** correct ?

(1) Hooke's joint is used to connect two rotating coplanar, non-intersecting shafts

(2) Hooke's joint is used to connect two rotating coplanar, intersecting shafts

(3) Oldham's coupling is used to connect two parallel rotating shafts

(4) Hooke's joint is used in steering mechanism of automobiles

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43. Maximum efficiency of screw jack

(1) increases with increase of load on the jack

(2) increases with increase of pitch of the screw

(3) increases with increase of coefficient of friction

(4) All of the above

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44. The size of the gear is usually specified by

(1) diametral pitch (2) pressure angle

(3) circular pitch (4) pitch circle diameter

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45. Consider the following statements :

I. The degree of freedom for lower kinematic pairs is always equal to one.

II. A ball and socket joint has three degrees of freedom and is higher kinematic pair.

III. Oldham's coupling mechanism has two prismatic pairs and two revolute pairs.

Which of the statements given above is/are correct ?

(1) I, II and III (2) I only (3) II and III (4) III only

SPACE FOR ROUGH WORK

46. For two meshing gears, their

(1) number of teeth must be same (2) addendum must be same

(3) dedendum must be same (4) module must be same

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47. The axis of spin, the axis of precession, and axis of applied gyroscopic torque are contained in

(1) one plane

(2) two planes perpendicular to each other

(3) three planes perpendicular to one another

(4) None of the above

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48. Net reaction of ground on wheels due to gyroscopic couple due to wheels and the dead weight and centrifugal force of a vehicle negotiating a curve is

(1) increased on inner wheels and decreased on outer wheels

(2) decreased on inner wheels and increased on outer wheels

(3) decreased on all wheels

(4) increased on all wheels

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49. When a ship travels in a sea, which of the following effects is more dangerous ?

(1) Steering (2) Pitching (3) Rolling (4) All of the above

---

50. Velocity ratio is constant for which of the following ?

(1) Chain drives and gears (2) Belt drives

(3) Rope drives (4) Belt and rope drives

---

51. The throw of cam is the maximum distance of the follower from

(1) Base circle (2) Pitch circle (3) Prime circle (4) Pitch curve

---

52. The pressure angle and the base circle in a cam should be

(1) both as big as possible

(2) respectively as low as possible and as big as possible

(3) respectively as big as possible and as low as possible

(4) both as low as possible

SPACE FOR ROUGH WORK P.T.O.

53. In case of ships, gyroscopic effect is ***not*** observed in which of the following motio

(1) Pitching (2) Steering (3) Yawing (4) Rolling

54. The spring loaded governors as compared to gravity controlled governors

(1) can operate at higher speeds

(2) are more compact and smaller in size

(3) are capable of being fixed at any inclination

(4) All of the above

55. In a Hartnell governor, if a spring of lower stiffness is used, then the governor will be

(1) isochronous (2) more sensitive

(3) less sensitive (4) None of the above

56. Bulk modulus of elasticity

(1) is independent of temperature

(2) increases with pressure

(3) increases with viscosity

(4) is independent of pressure and viscosity

57. The speed of sound in a fluid is given by the relation

(1) $c = \frac{S}{\gamma P}$ (2) $c = \sqrt{\gamma R T}$ (3) $c = \beta\sqrt{K T}$ (4) $c = \gamma P$

58. The dynamic viscosity of most of the gases with rise in gas temperature

(1) increases (2) increases as $\sqrt{T}$

(3) changes inversely as $\sqrt{T}$ (4) decreases

59. According to power law model, $\mu = m\left|\frac{du}{dy}\right|^{n-1}$. What is the flow behaviour index 'n' for pseudoplastic fluids ?

(1) $n = 0$ (2) $n = 1$ (3) $n < 1$ (4) $n > 1$

SPACE FOR ROUGH WORK

60. The depth of oil having specific gravity 0·6 to produce a pressure of 3·6 bar will

(1) 40 cm of oil (2) 36 cm of oil (3) 50 cm of oil (4) 60 cm of oil

---

61. If the pressure difference between the inside and outside of a soap bubble of 3 mm diameter is 16 N/m^2, then surface tension will be

(1) 0·12 N/m (2) $1{\cdot}2 \times 10^{-3}$ N/m

(3) 1·2 N/m (4) $12{\cdot}0 \times 10^{-3}$ N/m

---

62. In Laminar flow

(1) Experimentation is required for the simplest flow cases

(2) Newton's law of viscosity applies

(3) The fluid particles move in irregular and haphazard path

(4) Viscosity is unimportant

---

63. A glass bottle filled with liquid will break at the bottom if a stopper is forced into its open end as per

(1) Hydrostatic law (2) Pascal's law

(3) Gravitational law (4) Bernoulli's law

---

64. In turbulent flow in pipe

(1) Shear stress varies linearly with radius

(2) Head loss varies linearly with flow rate

(3) Fluid particles move in straight line

(4) Reynolds number is less than 1000

---

65. For laminar flow in a round pipe, the momentum correction factor is

(1) $\frac{1}{2}$ (2) $\frac{1}{3}$ (3) $\frac{4}{3}$ (4) $\frac{3}{4}$

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66. A flow in which each liquid particle has a definite path and their paths do not c each other is called

(1) Steady flow (2) Uniform flow

(3) Streamline flow (4) Turbulent flow

---

67. For turbulent flow through pipe, pressure drop is a function of

(1) Exponential velocity (2) Square root of velocity

(3) Cube of velocity (4) Square of velocity

---

68. The pressure inside a soap bubble of 10 mm diameter above atmosphere is

(1) 32 Pa (2) 16 Pa (3) 160 Pa (4) 0·32 Pa

---

69. In case of flow through orifices, the coefficient of velocity at vena contracta is

(1) equal to zero (2) equal to one

(3) greater than one (4) less than one

---

70. Continuity equation given below

$$\frac{\partial u}{\partial x} + \frac{\partial v}{\partial y} + \frac{\partial w}{\partial z} = 0$$

(1) is valid for steady flow whether the flow is compressible or incompressible

(2) is not valid for incompressible, unsteady flow

(3) is valid for incompressible flow whether the flow is steady or unsteady

(4) is valid for ideal fluid flow only

---

71. From Bernoulli's equation, plot of hydraulic grade line represents the _____ along the flow.

(1) sum of pressure and potential energy

(2) sum of pressure and kinetic energy

(3) sum of potential and kinetic energy

(4) sum of potential, pressure and kinetic energy

SPACE FOR ROUGH WORK

72. A venturimeter is preferable to orificemeter because

(1) it is cheaper (2) it is more convenient

(3) energy loss is less (4) it is easy to assemble

---

73. Which of the following variable area meters cannot be used with liquids containing large number of solid particles and at high pressure conditions ?

(1) Rotameter (2) Turbine flowmeter

(3) Orificemeter (4) Elbowmeter

---

74. A mercury manometer used for measuring pressure difference indicates 50 cm head of Hg. This pressure difference, in meters of water, will be

(1) 0·63 m (2) 6·3 m (3) 6·8 m (4) 0·68 m

---

75. In turbine flowmeter, the rotor movement is sensed by a

(1) Optical pick-up (2) Photovoltaic pick-up

(3) Reluctance pick-up (4) Piezoelectric pick-up

---

76. What is a thermodynamic process in which specific volume remains constant called ?

(1) Isometric (2) Isothermal (3) Isobaric (4) ISO 9000

---

77. In a multistage compressor, intercooling is done to

(1) maximise compressor work

(2) minimise compressor work

(3) maximise compressor temperature

(4) maximise power consumption

---

78. Two bodies are in thermal equilibrium if both have the same temperature reading even if they are not in contact. This is called

(1) First law of thermodynamics

(2) Zeroth law of thermodynamics

(3) Second law of thermodynamics

(4) Third law of thermodynamics

SPACE FOR ROUGH WORK P.T.O.

79. What is the process during which there is no heat transfer called ?

(1) Adiabatic (2) Isometric

(3) Isothermal (4) Polytropic

80. Conservation of energy principle is based on

(1) Zeroth law of thermodynamics

(2) Third law of thermodynamics

(3) Second law of thermodynamics

(4) First law of thermodynamics

81. Fossil fuels are used in

(1) Non-conventional energy production

(2) Conventional energy production

(3) Wind energy production

(4) Solar fuel cells

82. Which of the following sources of energy is ***not*** unconventional ?

(1) Wind energy (2) Geothermal energy

(3) Tidal energy (4) Coal Thermal Power Plants

83. Which of the following is a renewable source of energy ?

(1) Coal (2) Water (3) Oil (4) Uranium

84. A substance which has fixed chemical composition throughout is called a

(1) solid substance (2) hard substance

(3) pure substance (4) soft substance

85. A vapour which is about to condense is called

(1) subcooled vapour (2) saturated vapour

(3) superheated vapour (4) cold vapour

SPACE FOR ROUGH WORK

86. A cycle in which heat addition and heat rejection is at constant volume expansion and compression is isentropic is called

(1) Otto cycle (2) Diesel cycle

(3) Dual cycle (4) Carnot cycle

---

87. A cycle where expansion and compression is isothermal and heat addition and rejection is at constant volume is called

(1) Ericsson cycle (2) Carnot cycle

(3) Stirling cycle (4) Diesel cycle

---

88. We can increase the efficiency of Rankine cycle by

(1) lowering condenser pressure

(2) superheating steam to high temperature

(3) increasing boiler pressure

(4) All the above

---

89. Production of more than one useful form of energy from the same energy source is called

(1) Cogeneration (2) Coordination

(3) Corporation (4) Co-operation

---

90. Power cycle which is actually a combination of two cycles, one in high temperature region and the other in low temperature region is called

(1) Dual cycle (2) Duplicate cycle

(3) Twin cycle (4) Binary cycle

---

91. The fraction of heat input that is converted to net work output is a measure of performance of engine and is called as

(1) Mechanical efficiency (2) Kinematic efficiency

(3) Thermal efficiency (4) Simple efficiency

SPACE FOR ROUGH WORK P.T.O.

92. Heat is transferred to a heat engine from a furnace at a rate of 80 MW. If the ra waste heat rejection to a nearby river is 50 MW, what is the net power output ?

(1) 130 MW (2) 1·6 MW (3) 16 MW (4) 30 MW

93. "It is impossible for any device that operates on a cycle to receive heat from a single reservoir and produce a net amount of work." This statement is made by

(1) Clausis (2) Kelvin – Plank

(3) Rankine (4) Carnot

94. Frictionless pendulum is an example of

(1) Irreversible process (2) Reversible process

(3) Internal combustion engine (4) Heat engine

95. "The efficiency of an irreversible heat engine is always less than the efficiency of a reversible engine operating between the same two reservoirs." This is called

(1) Carnot principle (2) Rankine principle

(3) Otto principle (4) Dual principle

96. A fricionless heat engine can be 100% efficient only if its exhaust temperature is

(1) equal to its input temperature (2) less than its input temperature

(3) 0°C (4) 0°K

97. In a four-stroke cycle in S.I. engines the cam shaft runs

(1) at the same speed as crank shaft

(2) at half the speed of crank shaft

(3) at twice the speed of crank shaft

(4) at any speed irrespective of crank shaft speed

98. Gudgeon pin forms the link between

(1) piston and big end of connecting rod

(2) piston and small end of connecting rod

(3) connecting rod and crank

(4) big end and small end

SPACE FOR ROUGH WORK

99. For same compression ratio, thermal efficiency of Otto cycle is

(1) greater than that of Diesel cycle

(2) less than that of Diesel cycle

(3) same as that of Diesel cycle

(4) cannot be predicted

---

100. Pre-ignition in an engine may be detected by

(1) increase in speed (2) sudden loss of power

(3) typical sound (4) exhaust colouration

---

101. The knocking tendency in C.I. engines for a given fuel will be

(1) enhanced by decreasing compression ratio

(2) enhanced by increasing compression ratio

(3) unaffected by change in compression ratio

(4) None of these

---

102. Ignition coil is used to

(1) step up current (2) step down current

(3) step up voltage (4) step up power

---

103. Insulating material generally used in spark plug is

(1) wood (2) bakelite (3) polymer (4) porcelain

---

104. For CI engines, what are the most preferred fuels ?

(1) Naphthenes (2) Paraffins (3) Olefins (4) Aromatics

---

105. Detergents are oil additives used to

(1) reduce viscosity (2) increase fire point

(3) prevent sludge formation (4) prevent foaming

SPACE FOR ROUGH WORK P.T.O.

106. Volumetric efficiency is a measure of

(1) speed of the engine (2) power of the engine

(3) breathing capacity of the engine (4) pressure rise in the cylinder

---

107. Brake thermal efficiency of SI engines is in the range of

(1) 35% to 60% (2) 25% to 35%

(3) 60% to 80% (4) None of the above

---

108. The ratio of brake power to indicated power of an IC engine is called

(1) Mechanical efficiency (2) Thermal efficiency

(3) Volumetric efficiency (4) Relative efficiency

---

109. Oxides of nitrogen can be controlled by

(1) exhaust gas recirculation (2) catalyst

(3) water injection (4) All the above

---

110. The quantity of soot formed depends upon

(1) the local F/A ratios (2) the type of fuel

(3) the pressure (4) All the above

---

111. The conductivity of semi-conductor _____ with temperature.

(1) increases (2) decreases

(3) remains constant (4) None of the above

---

112. Access time is faster for

(1) ROM (2) SRAM (3) DRAM (4) EROM

---

113. In p-n type semi-conductor material, holes are

(1) minority charge carriers (2) donor atoms

(3) majority charge carriers (4) acceptor atoms

SPACE FOR ROUGH WORK

114. Breakdown of a P-N diode may occur due to

(1) Thermal instability (2) Tunneling effect

(3) Avalanche multiplication (4) All the above

---

115. In ideal inverting amplifier, the voltage gain

(1) can be adjusted as greater than one only

(2) can be adjusted as less than one only

(3) can be adjusted as equal to one only

(4) can be adjusted as greater than, equal to or less than one

---

116. For any amplifier, the gain-bandwidth product is always

(1) Gain × Bandwidth = Constant (2) Gain / Bandwidth = Constant

(3) Bandwidth / Gain = Constant (4) None of the above

---

117. The BJT transistor can be connected in a circuit in the following configuration :

(1) Common base configuration

(2) Common emitter configuration

(3) Common collector configuration

(4) All the above

---

118. Entire functioning of microprocessor is controlled by the

(1) Arithmetic logic unit (2) General purpose registers

(3) Control unit (4) Peripherals interfaced

---

119. If a UJT has an internal resistance 2 k ohm at rB_1 and 1 k ohm at rB_2, what is its intrinsic stand-off ratio ?

(1) 0·67 (2) 0·33 (3) 0·5 (4) 0·75

---

120. An identical OP-AMP is supposed to have

(1) Infinite input impedance (2) Zero output impedance

(3) Infinite bandwidth (4) All the above

SPACE FOR ROUGH WORK P.T.O.

PART B (विभाग ब)
MECHANICAL ENGINEERING

121. Multistage centrifugal pumps are used

(1) to produce high head (2) to give high discharge

(3) (1) and (2) above together (4) to pump viscous liquid

---

122. Specific speed of an impulse turbine mainly depends on

(1) Jet ratio (2) Number of buckets

(3) Jet velocity (4) Head

---

123. A Kaplan turbine is a

(1) high head, mixed flow turbine

(2) impulse turbine, inward flow

(3) reaction turbine, outward flow

(4) low head, axial flow turbine

---

124. For operating point of pump, a system characteristic between the head required 'H' and the discharge to be maintained 'Q' is generally expressed as

(1) Linear equation (2) Parabolic equation

(3) Exponential equation (4) Cubic equation

---

125. The dimensionless specific speed 'N_s' of a centrifugal pump is given by the relation

(1) $\frac{N\sqrt{P}}{H^{3/4}}$ (2) $\frac{N\sqrt{Q}}{H^{5/4}}$ (3) $\frac{N\sqrt{Q}}{(2H)^{3/4}}$ (4) $\frac{N\sqrt{Q}}{H^{3/4}}$

---

126. Effect of slip in case of centrifugal pump will

(1) reduce the flow rate (2) reduce the speed

(3) reduce the energy transfer (4) increase cavitation

---

127. Which of the following components of reciprocating pump is made of cast iron ?

(1) Cylinder (2) Air vessel (3) Foot valve (4) Shaft

SPACE FOR ROUGH WORK

128. The theoretical torque delivered by the hydraulic motor depends on

(1) Pressure only

(2) Pressure and Volumetric displacement

(3) Volumetric displacement only

(4) Pressure and Flow rate

---

129. The function of hydraulic accumulator is

(1) to store kinetic energy of the working fluid

(2) to store potential energy of the working fluid

(3) to store pressure energy of the working fluid

(4) All the above

---

130. _____ type of valves are used in hydraulic power steering systems of automobiles.

(1) Pressure compensated

(2) Non pressure compensated

(3) Proportional control

(4) Mechanical servo

---

131. The relation between coefficient of performance (COP) of refrigerator and heat pump working between the same temperature limits will be

(1) $COP_{HP} = COP_{ref} + 1$ (2) $COP_{ref} = COP_{HP} + 1$

(3) COP_{HP} is lower than COP_{ref} (4) unpredictable

---

132. Heat transfer in refrigeration system is controlled by

(1) Zeroth law of thermodynamics

(2) First law of thermodynamics

(3) Second law of thermodynamics

(4) All the laws of thermodynamics

SPACE FOR ROUGH WORK P.T.O.

133. Vapour compression refrigeration system uses throttling device instead of expansion turbine due to

(1) thermodynamic gain in performance

(2) better utilization of heat exchanger

(3) large cost reduction in expansion device

(4) saving in quantity of refrigerant

---

134. Ideal refrigerant – absorbent combination in vapour absorption refrigeration system shall ***not*** have

(1) low specific heat and low viscosity

(2) high solubility at generator condition

(3) high solubility at absorber condition

(4) low cost

---

135. CO_2, CFCs and Chlorine belong to a category of chemicals known as green house gases. Excess presence of these gases in the atmosphere leads to

(1) global warming (2) heavy rains

(3) protecting ozone layer (4) loss of soil fertility

---

136. Which of the following properties is ***not*** shown on psychrometric chart ?

(1) Dry bulb temperature (2) Wet bulb temperature

(3) Dew point temperature (4) Partial vapour pressure

---

137. Which is a secondary refrigerant ?

(1) Ammonia (2) R-134a

(3) Ethylene glycol (4) R-744

SPACE FOR ROUGH WORK

138. For 'Infiltration' and 'Ventilation' terms in air-conditioning, which is statement ?

(1) Both are putting cooling/heating load on plant

(2) Ventilation is deliberately provided, however infiltration occurs in an unwanted way

(3) Ventilation can be made zero

(4) Infiltration air quantity reduces ventilation air quantity

---

139. Which one of the following is ***not*** an application of air-conditioning ?

(1) Cold storage (2) Operation theater

(3) Water cooler (4) Heating cycle of shopping mall

---

140. The index, which correlates combined effects of air temperature, relative humidity and air velocity on human body is known as

(1) Mean radiant temperature (2) Effective temperature

(3) Dew point temperature (4) Wet bulb temperature

---

141. A sine bar is specified by

(1) its total length

(2) the centre distance between two rollers

(3) the size of rollers

(4) the distance between roller and upper surface

---

142. Henry Ford is noted for his contribution to

(1) Statistical quality control (2) Time and motion studies

(3) Assembly line operations (4) Scientific management

---

143. Tolerances are specified

(1) to obtain desired fits

(2) because it is not possible to manufacture a size exactly

(3) to obtain high accuracy

(4) to have proper allowance

SPACE FOR ROUGH WORK P.T.O.

144. Match the following types of layout generally employed for the manufacture of ite

A.	Product layout	I.	Construction of ship
B.	Process oriented layout	II.	Launch of satellite
C.	Fixed position layout	III.	Refining of crude oil
D.	Unit product layout	IV.	Assembly of automobile

	A	B	C	D
(1)	I	II	III	IV
(2)	IV	III	II	I
(3)	IV	III	I	II
(4)	II	I	IV	III

---

145. The basic purpose of multiple activity chart is to

(1) organise team of operatives on mass production work

(2) record activities of hands in relation to one another

(3) record the timing of each activity

(4) design the equipments

---

146. Job design means assigning the following tasks of a job to be performed by a worker in his daily routine :

I. Job enlargement is the horizontal loading of workers' job.

II. Job rotation is interchanging amongst workers after a suitable interval of time.

III. Job enrichment means giving additional responsibilities to workers who are more dignified.

Which of the statements given above are correct ?

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

(3) I and III only (4) I, II and III

SPACE FOR ROUGH WORK

147. _____ is the probability of a defective batch being accepted w... otherwise being rejected.

(1) Purchaser's risk

(2) Acceptable quality level

(3) Producer's risk

(4) Consumer's risk as well as producer's risk

---

148. There are two basic types of control charts :

I. When the method of inspection is by variables, the most popular control charts are $\bar{X}$ and R charts.

II. When the method of inspection is by attributes, the most popular control chart is P-charts.

Which of the above statements is/are true ?

(1) I only (2) II only (3) I and II (4) Neither I nor II

---

149. Process capability is independent of

(1) tooling (2) operator skill

(3) condition of machine (4) specifications of a job

---

150. Match the following :

A.	Micrometer	I.	Measurement of angle
B.	Sine bar	II.	Measurement of surface roughness
C.	Profilometer	III.	Measurement of diameter of cylinder
D.	Vernier callipers	IV.	Measurement of length of bar

	A	B	C	D
(1)	I	II	III	IV
(2)	III	I	II	IV
(3)	III	I	IV	II
(4)	IV	III	II	I

SPACE FOR ROUGH WORK P.T.O.

PART C (विभाग क)
AUTOMOBILE ENGINEERING

151. Suspension system on front wheels in modern cars is of

(1) rigid-axle type (2) leaf spring type

(3) independent suspension type (4) All of the above

---

152. In most of the vehicles, the front track as compared to the rear track is

(1) less (2) more (3) equal (4) All of the above

---

153. The automatic transmission requires use of the following control pedals :

(1) acceleration and clutch pedals

(2) clutch and brake pedals

(3) acceleration and brake pedals

(4) clutch, brake and acceleration pedals

---

154. The oldest braking system used on any automobile is

(1) mechanical braking on front wheels only

(2) engine exhaust braking system

(3) vacuum pump controlled braking system

(4) Girling braking system

---

155. The most suitable material for a brake drum is

(1) cast aluminium having cast iron bonded fins

(2) cast iron

(3) cast iron having aluminium bonded fins

(4) aluminium

---

156. One purpose of a recirculating ball type steering gear is to reduce the

(1) operating friction (2) operating cost

(3) toe-out during turns (4) number of parts

---

157. What does the brake bleeding process remove from the system ?

(1) Air (2) Vacuum (3) Excess fluid (4) Excess pressure

SPACE FOR ROUGH WORK

158. Three basic types of springs used in automotive suspension systems are

(1) coil, leaf and torsion bar (2) coil, torsion bar and air

(3) leaf, air and gas (4) All of the above

---

159. The frame may get distorted to a parallelogram shape due to

(1) weight of vehicle (2) weight of passengers

(3) cornering force (4) wheel impact with road obstacle

---

160. To resist bending, the best cross-section for a longitudinal member will be

(1) I-section (2) channel section

(3) angle section (4) tubular section

---

161. The percentage of the energy in the petrol burnt in the engine which is actually utilized in propelling the car is as little as

(1) 25% (2) 60% (3) 35% (4) 15%

---

162. Air resistance to a car at 20 km/hr is R. What would the air resistance at 60 km/hr be ?

(1) R (2) 2R (3) 9R (4) R^2

---

163. Spark plug may be fouled by

(1) Petrol (2) Oil (3) Lead (4) All of the above

---

164. At normal room temperature, the relative density of an electrolyte in a lead acid battery should be

(1) 13·6 (2) 12·6 (3) 1·28 (4) 0·128

---

165. A high rate discharge tester

(1) should always be used to test a flat battery

(2) should be used only if the battery is at least 70% charged

(3) can only be used on nickel alkaline cells

(4) determines the watt-hour capacity of a battery

---

166. The violent sound pulsations within the cylinder of an I.C. engine are due to

(1) detonation (2) turbulence

(3) pre-ignition (4) None of the above

SPACE FOR ROUGH WORK P.T.O.

167. A blocked air filter may cause

(1) low fuel consumption

(2) the engine to run rich

(3) increased cooling system pressure

(4) excess oxygen in the exhaust

---

168. Checking the phasing of an in-line fuel injection pump is carried out to

(1) ensure that fuel injection starts at the correct number of degrees after TDC

(2) ensure that each element commences delivery at the correct angular interval

(3) ensure that the engine cannot run backwards

(4) ensure that the lift pump is working

---

169. The PCV system controls which exhaust emissions ?

(1) HC (2) CO

(3) NO_x (4) Both HC and CO

---

170. A catalytic converter has to be at least how hot before it starts working ?

(1) 500°F (260°C) (2) 1000°F (540°C)

(3) 1500°F (815°C) (4) 2000°F (1100°C)

---

171. An application for the grant of authorisation for a tourist permit shall be made in Form 46 and shall be accompanied by a fee of ₹ _____ per annum in terms of a bank draft.

(1) 600 (2) 400 (3) 900 (4) 500

---

172. A motor vehicle belonging to a non diplomatic official of a diplomatic mission or a consular post in Delhi shall be assigned a registration mark consisting of letters _____ preceded by the number allotted to the mission or post by the Ministry of External Affairs of the Government of India and followed by the number allotted to the vehicle by the registering authority.

(1) CND (2) CDN (3) CDP (4) CCND

---

173. The registration mark should be illuminated by

(1) white light (2) red light (3) blue light (4) green light

SPACE FOR ROUGH WORK

174. As per CMVR 1989, the type approval of CNG kit for "Retrofitment" shall be for _____ years from the date of such approval and shall be renewable _____ years.

(1) 3, 2 (2) 3, 3

(3) 5, 3 (4) None of the above

175. Road tax paid on a vehicle in Maharashtra State is

(1) valid throughout India

(2) valid in Maharashtra only

(3) valid in neighbouring states only

(4) invalid throughout India

176. As per the CMVR, the speed governor of every transport vehicle shall be so set that the vehicle is incapable of being driven at a speed in excess of the maximum preset speed of the vehicle except

(1) while maneuvering or cruising (2) up an incline

(3) down an incline (4) None of the above

177. The Bombay Motor Vehicles Tax Act 1958 came in force on

(1) 1st April 1958 (2) 1st January 1958

(3) 1st June 1958 (4) 1st August 1958

178. Electric fans of _____ inches sweep adjustable, at least _____ in number, suitably spaced in the passenger compartment and controlled by switches located near the seat in case of tourist vehicles, is as per CMVR 1989.

(1) 7, 7 (2) 8, 8 (3) 9, 9 (4) 10, 10

179. Which of the following sections empowers the Central Government to make a scheme for payment of compensation in "hit and run" accident cases detailing the procedure for making a claim, the authorities to whom the claim should be made, etc.

(1) 146 (2) 147 (3) 163 (4) 213

180. According to Solatium Fund of Motor Vehicles Act, compensation to the victims of a hit and run motor accident for grevious injuries is

(1) ₹ 50,000 (2) ₹ 25,000 (3) ₹ 12,500 (4) ₹ 5,000

SPACE FOR ROUGH WORK

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 उमेदवाराबर 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

प्र. क्र. **201.** The Catch varies inversely with the size of the

(1) nozzle (2) droplet (3) obstruction (4) sprayer

ह्या प्रश्नाचे योग्य उत्तर "(3) obstruction" 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 स्वंतत्ररीत्या 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