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प्रश्नपुस्तिका क्रमांक
BOOKLET NO.

प्रश्नपुस्तिका
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अभियांत्रिकी

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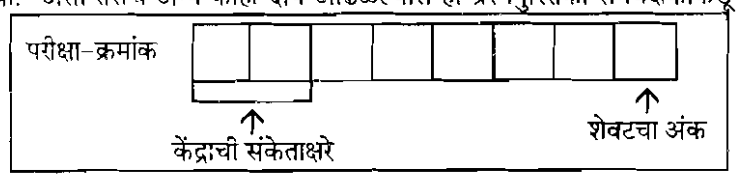
एकूण गुण : 300

वेळ : $2\frac{1}{2}$ (अडीच) तास

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''.**

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. Mollier diagram for a pure substance is a plot of _____.

(1) T - S (2) h - S (3) P - V (4) None of the above

2. The steam whose dryness fraction is to be determined, is at a pressure of 40 bar. Expected dryness fraction is approximately 0.85. The result can be obtained by :

(1) employing only throttling calorimeter

(2) employing separating and throttling calorimeter

(3) employing two throttling calorimeters

(4) None of the above as dryness fraction is too low to be determined by a calorimeter

3. Which of the following is an/are irreversible process/processes ?

(1) Any process involving friction

(2) Heat transfer across a finite temperature difference

(3) Turbulent flow

(4) All of the above.

4. Elongation of a straight bar of length L, Modulus of Elasticity E, and cross-sectional area A, which is hanging vertically from a fixed ceiling due to its own weight (W) is :

(1) WL/2AE (2) 2WL/AE (3) WA/2LE (4) 2WA/LE

5. A canitilever of uniform section carries a point load, P at the free end. The strain energy stored by cantilever is : (Modulus of Elasticity = E)

(1) $Pl^3/6EI$ (2) $P^2l^3/6EI$ (3) $P^3l^3/6EI$ (4) $Pl/6EI$

6. For an element in pure shear the principal planes are oriented at (w.r.t x-axis) :

(1) 0° (2) 45° (3) 90° (4) 22.5°

7. In mohr's circle, the distance of center of circle from y axis is :

(1) $\frac{6x - 6y}{2}$ (2) $\frac{6x + 6y}{2}$ (3) $\sqrt{6x^2+6y^2}$ (4) $6x-6y$

SPACE FOR ROUGH WORK

8. A cantilever beam of length l, is having a point load, W acting at the free end. Maximum deflection at the free end is : (Take modulus of Elasticity = E)

(1) $Wl^2/2EI$ (2) $Wl^3/3EI$ (3) Wl^3/EI (4) $Wl^2/3EI$

9. Martensite forms during _____ cooling of austenite.

(1) isothermal (2) gradual (3) slow (4) fast

10. For high temperature applications _____ materials are to be avoided.

(1) fine grained (2) coarse grained

(3) iron-based (4) None of the above

11. In a 0.35 wt% C steel (99.65 wt% Fe) what would be the percentage of total ferrite and cementite just below the eutectoid temperature ?

(1) 50% and 50% (2) 5% and 95% (3) 70% and 30% (4) 95% and 5%

12. Which of the following is **not** related to work hardening ?

(1) Frank - Reed source (2) Dislocations

(3) Cohesive strength (4) None of the above.

13. _____ is a most powerful solid solution strengthener for steel.

(1) Tungsten (2) Chromium (3) Phosphorus (4) Manganese

14. The purpose of martempering is :

(1) to minimise warping

(2) to maximise distortion and cracking

(3) to maximise percentage of Bainite

(4) to reduce hardness.

15. A cylindrical copper rod is cold worked to 12.2 mm diameter from 15.2 mm diameter. Find the percentage of cold work.

(1) 35.6 (2) 40.8 (3) 24.5 (4) 30.5

SPACE FOR ROUGH WORK

16. Hard particles of 2 micrometre diameter are dispersed in a Cu matrix. The average distance between particles is 20 μm. Find the stress of particles to the alloy. Take $G = 41\ G\ N/m^2$ and $b = 0.64$ nm

(1) $\tau = 1.312\ MN/m^2$ (2) $\tau = 1.121\ N/m^2$

(3) $\tau = 2.86\ N/m^2$ (4) $\tau = 1.928\ MN/m^2$

17. Overall heat transfer coefficient is calculated in case of :

(1) purely conduction phenomenon

(2) purely convection phenomenon

(3) combined conduction - convection phenomenon

(4) purely radiation phenomenon

18. For infinite parallel planes with emissivities ϵ_1 and ϵ_2, the interchange factor for radiation from surface 1 to surface 2 is given by :

(1) $\frac{\epsilon_1 \epsilon_2}{\epsilon_1 + \epsilon_2 - \epsilon_1 \epsilon_2}$ (2) $\frac{1}{\epsilon_1} + \frac{1}{\epsilon_2} - 1$ (3) $\epsilon_1 + \epsilon_2$ (4) $\epsilon_1 \epsilon_2$

19. Which of the following statements is incorrect ?

(1) At thermal equilibrium, the emissivity and absorptivity are same.

(2) Glasses are transparent to thermal radiations at short wavelengths

(3) The emissivity of a smooth surface is lower compared to a rough surface of the same material.

(4) Selective surfaces have same value of emissivity throughout the entire range of wavelength.

20. Modes of mass transfer are :

(1) diffusion (2) convection

(3) change of phase (4) All of the above

21. In the general heat transfer correlation for flow through tubes $N_u = 0.023\ Re^{0.8}\ P_r^n$ the value of n for fluid cooling is :

(1) 0.1 (2) 0.2 (3) 0.3 (4) 0.4

SPACE FOR ROUGH WORK

22. In steady state conduction with thermal conductivity given by $k = k_o(1 + \beta T)$ where β is positive, a slab of given thickness and given temperature drop will conduct :

(1) more heat at lower temperature levels

(2) more heat at higher temperature levels

(3) will be the same

(4) more data is required to comment

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23. In a binary mixture of two gases A and B, the diffusion coefficient can be obtained by :

(1) $D_{AB} = \frac{T^{\frac{3}{2}}}{P}$ (2) $D_{AB} = \frac{P^{\frac{3}{2}}}{T}$ (3) $D_{AB} = \frac{T^{\frac{2}{3}}}{P}$ (4) $D_{AB} = \frac{P^{\frac{2}{3}}}{T}$

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24. With usual notations, the effectiveness of heat exchanger is generally represented by :

(1) $\frac{C_h}{C_{min}} \cdot \frac{T_{h_1} - T_{h_2}}{T_{C_2} - T_{C_1}}$ (2) $\frac{C_c}{C_{min}} \cdot \frac{T_{C_2} - T_{C_1}}{T_{h_1} - T_{h_2}}$

(3) $\frac{C_c}{C_{min}} \cdot \frac{T_{h_1} - T_{h_2}}{T_{h_2} - T_{C_1}}$ (4) $\frac{C_h}{C_{min}} \cdot \frac{T_{h_1} - T_{h_2}}{T_{h_1} - T_{C_1}}$

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25. Arrange the following materials in the increasing order of their thermal conductivity.

Copper, Carbon steel, Nichrome, Silver

(1) Carbon steel, Silver, Nichrome, Copper

(2) Copper, Nichrome, Silver, Carbon steel

(3) Nichrome, Carbon steel, Copper, Silver

(4) Silver, Copper, Carbon steel, Nichrome

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26. Consider the following statements regarding condensation heat transfer.

(a) For a single tube, horizontal position is preferred over vertical position for better heat transfer.

(b) Heat transfer coefficient decreases if the vapour stream moves at high velocity.

(c) Condensation of steam on an oily surface is dropwise.

(d) Condensation of pure benzene vapour is always dropwise.

Of these statements :

(1) (a) and (b) are correct (2) (b) and (d) are correct

(3) (a) and (c) are correct (4) (c) and (d) are correct

SPACE FOR ROUGH WORK

27. Stress concentration factor is ratio of :

(1) $k_c = \frac{\text{Actual maximum stress}}{\text{Average stress}}$ (2) $k_c = \frac{\text{Average stress}}{\text{maximum stress}}$

(3) $k_c = \frac{\text{Minimum stress}}{\text{maximum stress}}$ (4) $k_c = \frac{\text{Average stress}}{\text{minimum stress}}$

28. A rotating shaft subjected to a steady, transverse - bending load will be designed for :

(1) fully reversed stress (2) repeated stress

(3) fluctuating stress (4) static stress

29. Accelerometer can be designed with ± 4 percentage error for frequency ratio less than or equal to 0.6, if value of the damping ratio lies in the range of :

(1) 0 to 1.0 (2) 0.2 to 0.9 (3) 0.3 to 0.8 (4) 0.65 to 0.7

30. Opening and closing of door using hydraulic door closer is an example of :

(1) underdamped system (2) critically damped system

(3) overdamped system (4) undamped system

31. The time between the points of zero amplitude or the points of maximum amplitude is called the period of beating and is given by :

(1) $\frac{2\pi}{(\omega - \omega_n)}$ (2) $\frac{2\pi}{(\omega_n - \omega)}$ (3) $\frac{(\omega_n - \omega)}{2\pi}$ (4) $\frac{(\omega - \omega_n)}{2\pi}$

32. For a critically damped system, the motion will be :

(1) periodic (2) aperiodic (3) harmonic (4) non - harmonic

SPACE FOR ROUGH WORK

33. Match the following :

(a)	Imbalance in diesel engine	(i)	can cause failure of turbine
(b)	Vibration in machine tools during metal cutting	(ii)	can cause wheels of locomotive to rise off the track
(c)	Blade and disk vibration	(iii)	can cause failure of bridge
(d)	Wind induced vibration	(iv)	can give rise to chatter

Answer options :

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

34. The area under stress - strain curve at any particular strain is called as :

(1) resilience (2) compliance (3) strain energy (4) Toughness

35. Which is more commonly used fatigue failure criteria for designing parts subjected to fluctuating loads ?

(1) Soderberg line (2) Goodman line

(3) Modified - Goodman line (4) Gerber parabola

36. At critical speed shaft tends to vibrate in :

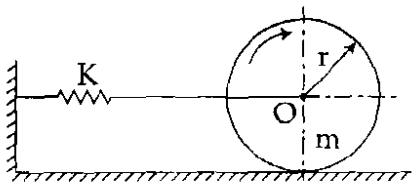
(1) longitudinal direction

(2) transverse direction

(3) Both longitudinal and transverse direction

(4) None of the above

37. The natural frequency of oscillation for the roller rolling on horizontal surface without slipping as shown in figure is given by :



(1) $\sqrt{\frac{3K}{2m}}$ (2) $\sqrt{\frac{K}{2m}}$ (3) $\sqrt{\frac{K}{3m}}$ (4) $\sqrt{\frac{2K}{3m}}$

SPACE FOR ROUGH WORK

38. Which is the correct torque equation for belt drive ?

(1) $T = (F_1 - F_2)\ d_{1/3}$ (2) $T = (F_1 - F_2) \times d_{1/2}$

(3) $T = (F_1 - F_2) \times R_{1/2}$ (4) None of the above

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39. To control double acting cylinder following final directional control valve is desired :

(1) $\frac{3}{2}$ directional control valve

(2) $\frac{5}{2}$ directional control valve

(3) dual pressure valve

(4) $\frac{2}{2}$ valve

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40. Data for an input to the ALU is temporarily stored in :

(1) status register (2) accumulator register

(3) program counter register (4) memory address register

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41. Rodless pneumatic actuators are used for positioning :

(1) heavy loads (2) medium loads

(3) light loads (4) All of the above

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42. The basis for determining the angle of departure from complex open-loop pole is :

(1) angles made by other open - loop poles and zeros to the concerned complex open - loop pole

(2) angle and magnitude of other open - loop poles and zeros to the concerned complex open - loop pole

(3) magnitude of other open - loop poles and zeros to the concerned complex open - loop pole

(4) None of the above

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43. Which of the following examples is an example of Mechatronics system ?

(1) Auto focus and Auto exposure camera

(2) Truck smart suspension system

(3) Automated production line

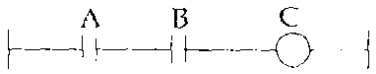
(4) All of the above.

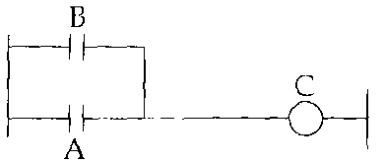
SPACE FOR ROUGH WORK

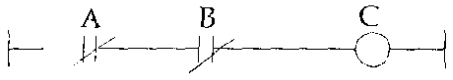
44. A pair of links having surface or area contact between the members is known as :

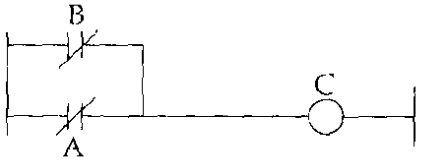
(1) sliding pair (2) turning pair (3) lower pair (4) higher pair

45. Which of the following diagrams is NAND function ?

(1) 

(2) 

(3) 

(4) 

46. If the axes of the first and the last wheels of a compound gear coincide, it is called a :

(1) simple gear train (2) compound gear train

(3) epicyclic gear train (4) reverted gear train

47. Which of the following components can be manufactured by powder metallurgy methods ?

(a) Carbide tool tips

(b) Bearings

(c) Filters

(d) Brake linings

Select the proper answer from the following :

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

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

SPACE FOR ROUGH WORK

48. The angle between the face and the flank of the single point cutting tool is known as

(1) rake angle (2) clearance angle (3) lip angle (4) point angle

49. In gas welding carburising flame is obtained by :

(a) excess of acetylene

(b) excess of oxygen

(c) excess of hydrogen

(d) None

Which of the statements given above is/are correct ?

(1) (a) only (2) (c) only

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

50. Newton's law of viscosity is given by the relation :

(1) $\tau = \mu^2 . \frac{du}{dy}$ (2) $\tau = \sqrt{\mu} . \frac{du}{dy}$ (3) $\tau = \mu \frac{du}{dy}$ (4) $\tau = (\mu)^{3/2} . \frac{du}{dy}$

51. Intensity of turbulence is :

(1) the average K. E. of turbulence.

(2) the violence of turbulent fluctuations and is measured by the RMS value of velocity fluctuations.

(3) the mean time interval between the reversals in the sign of velocity fluctuation

(4) None of the above.

52. Which of the following losses exist in hydraulic pumps ?

(1) Impeller recirculation losses (2) Friction losses

(3) Shock losses (4) All of the above

53. Which of the following is/are dimensionless turbine parameters ?

(1) Head coefficient (2) Capacity coefficient

(3) Power coeffcient (4) All of the above

SPACE FOR ROUGH WORK

54. Which of the following statements is **true** ?

(1) The viscosity of liquid increases but that of gases decreases with increase in temperature.

(2) The viscosity of liquid decreases but that of gases increases with increase in temperature.

(3) There is no effect of rise in temperature on viscosity of liquids and gases.

(4) In gases, molecular activity decreases with rise in temperature.

---

55. Pressure inside a water droplet is given by the relation :

(1) $P = \frac{4\sigma}{d}$ (2) $P = \frac{3\sigma}{d}$ (3) $P = \frac{8\sigma}{d}$ (4) $P = \frac{16\sigma}{d}$

---

56. Repeatability of measuring process is called as :

(1) Accuracy (2) Precision

(3) Sensitivity (4) Interchangeability

---

57. In perfect Gaussian distribution for $\pm 1\delta$ of μ which is correct value ?

(1) 60% (2) 66.66% (3) 33.33% (4) 68%

---

58. Which of the following instruments is/are used for angle measurement ?

(1) Universal Beval Protractor (2) Sine Bar

(3) Autocollimator (4) All of the above

---

59. In axially loaded elastic member strain E is :

(1) directly proportional to pressure and inversely proportional to Young's modulus.

(2) inversely proportional to pressure and directly proportional to Young's modulus.

(3) inversely proportional to area and inversely proportional to pressure.

(4) directly proportional to area and inversely proportional to Young's modulus

---

SPACE FOR ROUGH WORK

60. Following statements are related to the strain gauge wires :

(a) Strain gauge wire should have high resistance

(b) Strain gauge wire should have low elastic limit

(c) Strain gauge wire should be insensitive to temperature in both its physical and electrical properties.

Of these _____ :

(1) (a) is true and (b) and (c) are false

(2) (b) is true and (a) and (c) are false

(3) (a) and (c) are true and (b) is false

(4) All (a), (b), and (c) are true.

---

61. Which among the following has negative temperature coeffcient of resistance ?

(1) K– type thermocouple (2) Resistance temperature detector

(3) Thermistor (4) Thermocouple

---

62. Total Range of input values possible for a given output is :

(1) Span (2) Resolution

(3) Dead zone (4) All of the above

---

63. Which of the following dispatching rules tends to minimize job flow time ?

(1) FCFS : First Come, First Serve

(2) SPT : Shortest Processing Time

(3) LPT : Longest Processing Time

(4) EDD : Earliest Due Date

---

64. The most appropriate sequencing rule to use if the goal is to dynamically track the progress of jobs and establish relative priority on a common basis :

(1) Shortest Processing Time

(2) Earliest Due Date

(3) Critical ratio

(4) Johnson's ratio

SPACE FOR ROUGH WORK

65. To find the optimal solution to a linear programming problem using the graphical method :

(1) find the feasible point that is closest to the origin

(2) find the feasible point that is at the highest location

(3) find the feasible point that is farthest away from the origin

(4) None of the above.

---

66. Which of the following most closely describes net material requirements ?

(1) Gross requirement − Planned order receipts

(2) Gross requirement − On Hand − Planned order receipts

(3) Gross requirement − On Hand + Planned order receipts

(4) None of the above

---

67. A master production schedule specifies :

(1) the financial resources required for production

(2) what component is to be made, and when

(3) what product is to be made, and when

(4) the labour hours required for production

---

68. A firm uses simple exponential smoothing with $\alpha = 0.02$ to forecast demand. The forecast for the first week of January was 400 units, where as actual demand turned out to be 450 units. Forecast the demand for the second week of January.

(1) 410 (2) 395

(3) 405.7 (4) None of the above

---

69. In PERT, each activity requires :

(1) an optimistic time (2) a most likely time

(3) a pessimistic time (4) All of the above

SPACE FOR ROUGH WORK

70. Which of the statements given below is/are correct ?

(a) Brushless DC motor is an AC machine

(b) Stepper motor is always used with closed loop control

(c) Induction generator is preferred in Thermal power stations

(d) None of the above

(1) (a) only (2) (d) only

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

---

71. In two - phase AC servomotor, stator windings are displaced from each other by _____

(1) 120° (2) 90° (3) 180° (4) None of these

---

72. In a 3 - phase induction motor, the variable mechanical load is electrically represented by :

(1) a variable resistance only.

(2) a variable inductance only.

(3) a variable capacitance only.

(4) a combination of variable resistance and variable inductance.

---

73. For power transformer, η_{max} _____ with _____ power factor and is highest at _____ power factor.

(1) increases, increasing, unity

(2) decreases, increasing, leading

(3) increases, decreasing, lagging

(4) decreases, decreasing, unity

---

74. In a transformer the exciting current has two components - magnetising component and core - loss component. Neglecting leakage impedance drop :

(1) both of them lag the impressed voltage by 90°.

(2) both of them are in phase with the impressed voltage.

(3) the former lags the impressed voltage by 90° while the later is in phase with the impressed voltage.

(4) the former is in phase with the impressed voltage while the later lags the impressed voltage by 90°.

SPACE FOR ROUGH WORK

75. A 3 - phase synchronous motor connected to infinite bus is operating at half of full load with normal excitation. When the load on the synchronous motor is suddenly increased :

(1) its speed will first decrease and then become synchronous.

(2) its speed will remain unchanged.

(3) its speed will first increase and then become synchronous.

(4) its speed will fluctuate around synchronous speed and then become synchronous.

---

76. The starting torque of an induction motor will be maximum when :

(1) started by an auto transformer

(2) started by star delta starting

(3) directly switched on

(4) started by reactance starting

---

77. A 3 - phase synchronous motor driving a constant load torque draws power from the infinite bus at a loading power factor. If the excitation is increased :

(1) the power angle decreases while power factor increases.

(2) the power angle increases while power factor decreases.

(3) both power angle and power factor increase.

(4) both power angle and power factor decrease.

---

78. Under the ABC system of inventory priorities a class A item is :

(1) the 20% of high value items that account for around 80% the total stock value.

(2) the 80% of high value items that account for around 20% the total stock value.

(3) the 80% of high value items that account for around 80% the total stock value.

(4) None of the above

---

79. The Regulatory Commission while determining the cross subsidy reduction roadmap for the Distribution licensees may consider factors :

(1) Tariff shock to affected consumers

(2) Future increases in distribution and retail costs

(3) Changes in consumer mix

(4) All of the above

SPACE FOR ROUGH WORK

80. The manufacturing philosophy and technique that seek the elimination of waste and continuous improvement :

(1) MRP (2) JIT

(3) Theory of constraints (4) All of the above

---

81. If the neutral in 3 phase, 4 wire unbalanced system is disconnected, the potential difference across high resistance will _____ and that across the low resistance will _____.

(1) increase, increase (2) increase, decrease

(3) decrease, decrease (4) decrease, increase

---

82. The low voltage (LT) cables are used for operating voltage upto _____volt and the super tension (ST) cables for operating voltage upto _____ volt.

(1) 1000 V, 33000 V (2) 33000 V, 66000 V

(3) 1000 V, 66000 V (4) 1000 V, 11000 V

---

83. The sag of conductors supp at the same level is given by Approximate formulae as where, Sag-s, L-length, W-weight of conductor per meter length (kg), T-tension.

(1) $\text{Sag (s)} = \frac{W^2L^3}{24T^2}$ (2) $\text{Sag (s)} = \frac{WL^2}{8T}$

(3) $\text{Sag (s)} = \frac{WL^2}{4T}$ (4) $\text{Sag (s)} = \frac{WL^3}{8T}$

---

84. According to the Electricity Act, 2003, "Subsidizing Consumer Category" means the consumer category :

(1) which pays tariff more than its cost of supply as determined by the Commission.

(2) which pays tariff less than its cost of supply as determined by the Commission.

(3) which pays tariff more or less than its cost of supply as determined by the Commission.

(4) Both (2) and (3).

SPACE FOR ROUGH WORK

85. The string η of the overhead insulator is given by :

(1) $\eta_{string} = \frac{\sqrt{3} \text{ voltage across the string}}{\text{no.of strings} \times \text{ voltage across the lowermost unit}}$

(2) $\eta_{string} = \frac{3 \text{ voltage across the string}}{\text{no.of strings} \times \text{ voltage across the uppermost unit}}$

(3) $\eta_{string} = \frac{\text{voltage across the string}}{\text{no.of strings} \times \text{ voltage across the lowermost unit}}$

(4) $\eta_{string} = \frac{\text{voltage across the string}}{(\text{no.of strings} - 1) \times \text{ voltage across the lower unit}}$

---

86. The transfer function of the system is :

(1) Laplace transform of its impulse response and is applicable to linear - time invariant system only

(2) Fourier transform of its impulse response and is applicable to linear - time invariant system only

(3) Laplace transform of its step response and is applicable to linear - time invariant system only

(4) Fourier transform of its step response and is applicable to linear - time invariant system only

---

87. Potentiometer is used as an error detector and its performance is characterised by :

(1) Resolution (2) Linearity and loading error

(3) Life and noise (4) All of the above

---

88. Synchro control transformer is an electro-mechanical device which produces :

(a) Single phase voltage

(b) Three phase voltage

(c) Voltage proportional to 'sine' of the angle of rotor with respect to stator magnetic field.

(d) Voltage proportional to 'tan' of the angle of rotor with respect to stator magnetic field.

Which of the above statements is/are correct ?

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

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

SPACE FOR ROUGH WORK

89. The transfer function of a system is given by T.F=$\frac{k(s+3)}{s(s+2+j4)(s+2-j4)}$. The number of poles the system has :

(1) One (2) Two (3) Three (4) Four

90. A feedback control system :

(a) reduces sensitivity to variation in parameters in forward path.

(b) reduces sensitivity to variation in parameters in feedback path.

(c) increases sensitivity to variation in parameters in feedback path.

(d) do not reduce the sensitivity to variations in parameters in feedback path.

Which of the above statements is/are correct ?

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

(3) (a) only (4) (a) and (c)

91. The effect of PI controller on system response is :

(a) eliminate steady state error.

(b) decreases rise time and increases overshoot and setting time

(c) increases rise time and decreases overshoot and setting time

(d) increases overshoot and decreases rise time and setting time

Which of the above statements is/are correct ?

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

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

92. AC servomotors used in low power control applications are basically :

(1) Synchronous motors (2) Three phase induction motors

(3) Two phase induction motors (4) Universal motors

SPACE FOR ROUGH WORK

93. A control system composed of components whose forward path transfer function is $G(s) = G_1(s).\ G_2(s)$ where $G_1(s) = \frac{1}{s+2}$ and $G_2(s) = \frac{10}{s}$. The overall transfer function of this unity feedback control system is :

(1) $\frac{10}{s^2 + 2s + 10}$ (2) $\frac{10}{s^2 + s + 1}$

(3) $\frac{1}{s^2 + s + 1}$ (4) $\frac{1}{s^2 + 2s + 10}$

---

94. Use of Star - Delta starter in Induction motor, reduces starting torque to :

(1) half of normal torque.

(2) one-fourth of torque with direct start.

(3) one-third of normal starting torque.

(4) Seventy percent of normal starting torque.

---

95. Armature voltage control of dc motor is useful in which of the following cases ?

(1) Above base speed with constant torque

(2) Below base speed with constant power

(3) Above base speed with constant power

(4) Below base speed with constant torque

---

96. Which one of the following Drives can be defined as digital electro-mechanical device where moment of shaft is in discrete angle ?

(1) Shaded Pole Motor

(2) Stepper Motor

(3) D. C servomotor

(4) Capacitor split single phase motor

SPACE FOR ROUGH WORK

97. In which type of Electric braking generated energy is supplied to the source during braking ?

(1) Plugging
(2) Regenerative braking
(3) Dynamic braking
(4) Reverse voltage braking

98. In V/F speed control method of Induction motor, ratio of voltage to frequency is maintained constant to achieve :

(1) constant Running torque
(2) constant flux
(3) constant current
(4) constant speed

99. In closed - loop speed control of Electric Drive, which two controllers are used for safe operation ?

(1) Speed controller and voltage controller
(2) Speed controller and current controller
(3) Voltage and current controller
(4) Proportional and integral controller

100. Static Scherbius Drive is used for speed control of :

(1) Wound rotor Induction Motor below synchronous speed
(2) Squirrel cage Induction Motor above synchronous speed
(3) Squirrel cage Induction Motor below synchronous speed
(4) D. C shunt motor below base speed.

101. Dual converter fed D.C Drive can operate in :

(1) First and second quadrant of operation
(2) First and third quadrant of operation
(3) All four quadrants of operation
(4) None of the above

SPACE FOR ROUGH WORK

102. Electrical system consisting one of the following combination is called as Electric Drive.

(1) Power converter, Sensors, Electric load

(2) Power modulator, Feedback control and motor

(3) Power modulator, Electric Motor and load

(4) Power converter, Motor and rotational load

---

103. The total torque developed in Electric Drive is divided as :

(1) Friction torque, Windage torque and useful torque

(2) Friction torque, loss torque, output torque

(3) Friction torque, load torque, useful torque

(4) Useful torque, fluctuating torque, load torque

---

104. Match the pair for typical power factor for some of the common appliances :

	Type of load	**Power factor**
(a)	Incandescent lamps	(i) 0.85
(b)	Arc welders	(ii) 0.3 - 0.7
(c)	Arc lamps used in cinemas	(iii) 0.98 - 1.0
(d)	Induction heaters	(iv) 0.3 - 0.4

Answer options :

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

---

105. The economic load dispatch is carried out on the basis of _____

(1) equal incremental cost criteria (2) equal area criteria

(3) loss minimization criteria (4) maximize generation criteria

---

SPACE FOR ROUGH WORK

106. The penalty factor in economic dispatch of generator is approximately calculated by____

(1) $PF_i \cong \dfrac{1}{1-\dfrac{\Delta P_L}{\Delta P_i}}$ (2) $PF_i \cong 1+\dfrac{\Delta P_L}{\Delta P_i}$

(3) $PF_i \cong \dfrac{1}{1+\dfrac{\Delta P_i}{\Delta P_L}}$ (4) $PF_i \cong \dfrac{\Delta P_L}{1-\dfrac{\Delta P_i}{\Delta P_L}}$

---

107. The mathematical definition of demand factor is given by _____ and co-incidence factor as _____

(1) $\dfrac{\text{Maximum demand}}{\text{connected load}}, \dfrac{\text{Sum of individual maximum demands}}{\text{maximum demand of power station}}$

(2) $\dfrac{\text{connected load}}{\text{Average demand}}, \dfrac{\text{maximum demand of power station}}{\text{Sum of individual maximum demands}}$

(3) $\dfrac{\text{maximum demand}}{\text{connected load}}, \dfrac{\text{maximum demand of power station}}{\text{Sum of individual maximum demands}}$

(4) $\dfrac{\text{Average demand}}{\text{maximum demand}}, \dfrac{\text{maximum demand of power station}}{\text{Sum of individual maximum demands}}$

---

108. For the same maximum demand, if load factor is decreased the cost of energy is _____.

(1) increased (2) decreased

(3) not affected (4) remains constant

---

109. Load frequency control is achieved by properly matching the individual machine's :

(1) reactive power (2) generated voltages

(3) turbine inputs (4) All of the above

SPACE FOR ROUGH WORK

110. Maintaining net injected real power constant, the minimization of the real injected power P_i slack bus is also known as _____problem.

(1) Optimal real power flow (2) Optimal load scheduling

(3) Optimal generation scheduling (4) Optimal reactive power flow

---

111. Unscheduled Interchange charges (UI charges) are payable/receivable if _____

(i) A beneficiary overdraws power, thus by decreasing the frequency

(ii) A beneficiary underdraws power, thus by increasing the frequency

(iii) A generator generates more than the schedule, thereby increasing the frequency

(iv) A generator generates less than the schedule, thereby decreasing the frequency

(1) only (i) and (ii) (2) only (i) and (iii)

(3) only (iii) and (iv) (4) All of the above

---

112. In the energy-broker system the members exchange _____ quotations of prices at which each is willing to buy and sell energy.

(1) monthly (2) weekly (3) hourly (4) yearly

---

113. In the presence of bad measurements, state estimates are **not** reliable. Then diagonal elements of covariance matrix $R' = R - H_x G_x^{-1} H_x^T$ are used to calculate_____ to identify bad measurements.

(1) gain matrix (2) largest standardised residuals

(3) estimated measurement error (4) standard Gramian density function

---

114. 0 – 10 mA PMMC ammeter is connected in series with the 0.004 ohm resistance the current flowing through the resistance is 4 mA. If the bottom control spring snaps suddenly, what will be the ammeter reading ?

(1) 4 mA (2) 1 mA (3) 0 mA, (zero) (4) 8 mA

---

115. Temperature range (in °C) for platinum type Resistance Thermometer is :

(1) 0 to 180 (2) −260 to 1100

(3) −220 to 300 (4) −200 to 1000

SPACE FOR ROUGH WORK

116. Find the odd man out :

(1) Ammeter - Voltmeter method (2) Substitution method

(3) Ohmmeter method (4) Megaohm meter

---

117. Gauge factor of Strain Gauge is defined as :

(1) $G_f = \frac{\Delta R/R}{\Delta L/L}$ (2) $G_f = \frac{\Delta R/R}{\epsilon}$

(3) $G_f = 1 + 2V + \frac{\Delta \rho/\rho}{\epsilon}$ (4) All of the above

---

118. A 20 kW resistive load is connected to a 440 V supply through digital energy meter. If the load is continuously on from 6.00 am to 11.00 am. What will be the reading of energy meter after 3 hours ? Consider initial energy meter reading as 5 unit before starting the load.

(1) 100 kW Hour (2) 20 kW Hour

(3) 65 kW Hour (4) 60 kW Hour

---

119. The output of an LVDT is connected to a 5 V voltmeter through an amplifier whose amplification factor is 250. An output of 2 mV appears across the terminals of LVDT when the core moves through a distance of 0.5 mm. If the milli-voltmeter scale had 100 divisions and the scale could be read to $\frac{1}{5}^{th}$ of a division, the resolution of the instrument (in mm) is :

(1) 2×10^{-3} (2) 1×10^{-3} (3) 0.5×10^{-3} (4) 0.25×10^{-3}

---

120. A CRO screen has ten devisions on the horizontal scale. If voltage signal $V = 5 \times \sin(314t + 45°)$ is examined with the base setting 5 msec/div, the number of cycles of signal displayed on the screen will be :

(1) 0.5 cycles (2) 2.5 cycles (3) 5 cycles (4) 10 cycles

SPACE FOR ROUGH WORK

121. Damper winding is designed in synchronous motor to :

(1) suppress negative sequence field and to damp oscillations during hunting.

(2) provide starting torque and damping power during hunting.

(3) provide maximum torque and avoid hunting.

(4) avoid crawling and cogging.

---

122. In three phase induction motor higher value of average flux density in air gap results in :

(1) higher overload capacity and improved power factor

(2) lower overload capacity and improved power factor

(3) higher overload capacity and poor power factor

(4) lower overload capacity and poor power factor

---

123. A short time intermittent rating of electric motor is considered while selecting motor for :

(1) blowers (2) punching machine

(3) reciprocating compressor (4) sirens

---

124. Which is the most critical part in the design of electrical machines ?

(1) Conductor (2) Core (3) Insulation (4) Air gap

---

125. By providing deep narrow slots in the rotor punching in induction motor :

(1) starting torque can be increased

(2) running torque can be reduced

(3) efficiency can be improved

(4) None of the above

---

126. The humming sound in a transformer is due to :

(1) vibration in cooling oil (2) vibration in lamination

(3) sinusoidal voltage waveform (4) inductance of the transformer winding

---

SPACE FOR ROUGH WORK

127. Leakage reactance/phase of the stator of a 3 phase induction motor is 1.0 Ω. The turns/phase of the stator are increased by 10%. The leakage reactance is then equal to :

(1) $(1.1)^2$ (2) $\frac{1}{(1.1)^2}$ (3) $(0.9)^2$ (4) $\frac{1}{(0.9)^2}$

---

128. Match the following :

(a)	Cylindrical winding	(i)	Low V, high current
(b)	Disc winding	(ii)	High V, high current
(c)	Crossover winding	(iii)	Low V, low current
(d)	Helical winding	(iv)	Medium V, low current

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

---

129. In D.C armature design, the following details are given : 6 poles, 43 slots, 4 circuits with 43 segments, then the type of winding is :

(1) Singly re - entrant duplex wave winding

(2) Doubly re - entrant duplex wave winding

(3) Singly re - entrant duplex lap winding

(4) Doubly re - entrant duplex lap winding

---

130. Electrical machine designed for higher speed for given output power results in :

(1) Smaller size and higher cost (2) Smaller size and lower cost

(3) Larger size and lower cost (4) Larger size and higher cost

---

131. The amount of heat given out due to combustion of 1kg of solid or liquid fuel or 1 cum of gaseous fuel is called as :

(1) sensible heat (2) calorific value (3) latent heat (4) heat factor

---

SPACE FOR ROUGH WORK

132. The role of moderator in a nuclear reactor is to :

(1) control the speed of neutrons in chain reaction

(2) separate the neutrons

(3) release the energy from nucleous

(4) act as catalyst for chain reaction

---

133. Compounding of steam turbine is done for :

(1) reducing the work done (2) increasing the rotor speed

(3) reducing the rotor speed (4) balancing the turbine

---

134. Load factor of a power plant is defined as :

(1) Maximum demand / average load

(2) Maximum demand × average load

(3) Average load / maximum demand

(4) (1 / maximum demand × average load) × 100

---

135. Pertaining to blower performance Match **List I** with **List II**.

	List I		**List II**
(a)	Slip	(i)	Reduction of whirl velocity
(b)	Stall	(ii)	Fixed mass flow rate regardless of pressure ratio
(c)	Chocking	(iii)	Flow separation
		(iv)	Flow area reduction

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

SPACE FOR ROUGH WORK

136. Quantity of heat 'Q' supplied to a substance to increase its temperature depends upon the following :

(1) sensible heat (2) latent heat

(3) saturation temperature (4) atmospheric temperature

---

137. The specific speed (N_s) of the turbine is given by :

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

---

138. The steam turbine in which the pressure of steam falls in the nozzles and remains almost constant in the blade ring is called as :

(1) Reaction turbine (2) Impulse turbine

(3) Francis turbine (4) Back pressure turbine

---

139. Hydrograph is the graph showing the relation between :

(1) discharge of flowing water with respect to head

(2) discharge of flowing water with respect to time

(3) discharge of flowing water with respect to rainfall

(4) discharge of flowing water with respect to catchment area

---

140. In forced circulation boilers, about 90% of water is recirculated without evaporation. The circulation ratio is :

(1) 0.1 (2) 0.9 (3) 9 (4) 10

---

141. Solar radiations reach at earth surface in two forms, one as direct beam and second as _____ radiation.

(1) infrared (2) diffused (3) dispersed (4) ultraviolet

SPACE FOR ROUGH WORK

142. Which of the wind patterns need to be looked at when evaluating wind sites for installation ?

(1) diurnal ; nocturnal
(2) short term ; long term
(3) summer ; winter
(4) All of the above

143. In solar pond, bottom layer is made highly salty to :

(1) supress convection to maintain hot water at bottom.
(2) increase reflection of radiations.
(3) increase convection to reduce temperature.
(4) increase convection to raise up hot water.

144. The axis of a horizontal axis wind turbine is :

(1) parallel to the ground and located at top of the tower
(2) perpendicular to the ground and located at top of the tower
(3) parallel to the ground and located at ground level
(4) perpendicular to the ground and located at ground level

145. In fuel cell, electro-chemical reaction which produces electric power requires :

(1) hydrogen and oxygen as input and generate water and heat as resultant.
(2) hydrogen and water as input and generate oxygen and heat as resultant.
(3) hydrogen and heat as input and generate oxygen and water as resultant.
(4) hydrogen as input and oxygen, heat and water as resultant.

146. Wind turbine blades are subjected to which of the following types of loads ?

(1) Transient
(2) Translational and Transient
(3) Stochastic and Transient
(4) Translational and Stochastic

SPACE FOR ROUGH WORK

147. Efficiency of fuel cell is highest because :

(1) heat energy of fuel is directly converted into electrical energy

(2) kinetic energy in fuel is converted into heat energy

(3) chemical energy of fuel is directly converted into electrical energy

(4) potential energy of fuel is converted into electrical energy

---

148. The solar energy is a huge source and the power from the sun intercepted by earth is about :

(1) 1.8 GW (2) 1.8×10^{11} MW (3) 5.0×10^{3} GW (4) 100 GW

---

149. The device which intercepts incident solar radiation and converts it into heat is called as :

(1) Solar reflector (2) Solar absorber

(3) Solar collector (4) Solar radiator

---

150. In wind power generation, 'A' is turbine intercepting a cross-section of wind front and u_0 is wind speed, then power of turbine P_T is :

(1) $P_T \propto A\, u_0^2$ (2) $P_T \propto u_{0/A}$ (3) $P_T \propto A\, u_0^3$ (4) $P_T \propto A\, u_0$

- o 0 o -

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 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

प्रश्न 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" हे आहे. त्यामुळे या प्रश्नाचे उत्तर "(3)" होईल, आता खालीलप्रमाणे प्रश्न क्र. 201 समोरील उत्तर-क्रमांक "③" चा वर्तुळ खालीलप्रमाणे 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