A

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प्रश्नपुस्तिका क्रमांक
BOOKLET NO.

प्रश्नपुस्तिका
चाळणी परीक्षा
यंत्र अभियांत्रिकी

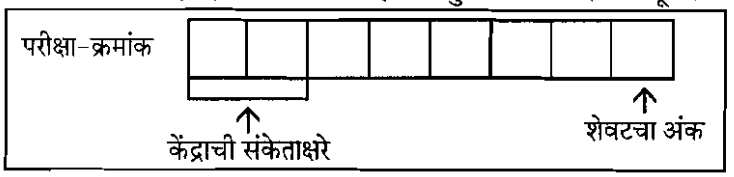
वेळ : 3 (तीन) तास

एकूण प्रश्न : 80
एकूण गुण : 200

सूचना

(1) सदर प्रश्नपुस्तिकेत 80 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 पर्यायापैकी सर्वात योग्य उत्तरेच उत्तरपत्रिकेत नमूद करावीत. अन्यथा त्यांच्या उत्तरपत्रिकेत सोडविलेल्या प्रत्येक चार चुकीच्या उत्तरांसाठी एका प्रश्नाचे गुण वजा करण्यात येतील''.**

पर्यवेक्षकांच्या सूचनेविना हे सील उघडू नये

ताकीद

ह्या प्रश्नपत्रिकेसाठी आयोगाने विहित केलेली वेळ संपेपर्यंत ही प्रश्नपुस्तिका आयोगाची मालमत्ता असून ती परीक्षाकक्षात उमेदवाराला परीक्षेसाठी वापरण्यास देण्यात येत आहे. ही वेळ संपेपर्यंत सदर प्रश्नपुस्तिकेची प्रत/प्रती, किंवा सदर प्रश्नपुस्तिकेतील काही आशय कोणत्याही स्वरूपात प्रत्यक्ष वा अप्रत्यक्षपणे कोणत्याही व्यक्तीस पुरविणे, तसेच प्रसिद्ध करणे हा गुन्हा असून अशी कृती करणाऱ्या व्यक्तीवर शासनाने जारी केलेल्या ''परीक्षांमध्ये होणाऱ्या गैरप्रकारांना प्रतिबंध करण्याबाबतचा अधिनियम-82'' यातील तरतुदीनुसार तसेच प्रचलित कायद्याच्या तरतुदीनुसार कारवाई करण्यात येईल व दोषी व्यक्ती कमाल एक वर्षाच्या कारावासाच्या आणि/किंवा रुपये एक हजार रकमेच्या दंडाच्या शिक्षेस पात्र होईल.

तसेच ह्या प्रश्नपत्रिकेसाठी विहित केलेली वेळ संपण्याआधी ही प्रश्नपुस्तिका अनधिकृतपणे बाळगणे हा सुद्धा गुन्हा असून तसे करणारी व्यक्ती आयोगाच्या कर्मचारीवृंदापैकी, तसेच परीक्षेच्या पर्यवेक्षकीयवृंदापैकी असली तरीही अशा व्यक्तीविरूद्ध उक्त अधिनियमानुसार कारवाई करण्यात येईल व दोषी व्यक्ती शिक्षेस पात्र होईल.

पुढील सूचना प्रश्नपुस्तिकेच्या अंतिम पृष्ठावर पहा

कच्च्या कामासाठी जागा / SPACE FOR ROUGH WORK

1. $\frac{\partial^2 u}{\partial t^2} = c^2 \frac{\partial^2 u}{\partial x^2}$ represents the equation for :

   (1) Vibration of a stretched string

   (2) Motion of a projectile in a gravitational field

   (3) Heat flow in thin rod

   (4) Oscillation of a simple pendulum

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2. Solution of the differential equation $\frac{d^2y}{dx^2} + 4y = \sin^2 x$ is :

   (1) $C_1 \sin 2x + C_2 \cos x + \frac{1}{8} + \frac{x}{8} \sin 2x$ (2) $C_1 x + C_2 \cos x + \frac{1}{8} - \frac{x}{8} \sin 2x$

   (3) $C_1 \cos 2x + C_2 \sin 2x + \frac{1}{8} - \frac{x}{8} \sin 2x$ (4) $C_1 \cos 2x + C_2 \sin x + \frac{1}{8} + \frac{1}{8} \sin 2x$

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3. The operation of making a cone shaped enlargement of the end of a hole is known as :

   (1) counter sinking (2) counter boring (3) trepanning (4) spot facing

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4. A car travelling at a speed of 60 km/hour is braked and comes to rest 6 seconds after the brakes are applied. The minimum coefficient of friction between the wheels and the road would be :

   (1) 0.107 (2) 0.283 (3) 0.3 (4) 0.417

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5. Barometer is used to measure :

   (1) velocity of liquid

   (2) atmospheric pressure

   (3) pressure in pipes and channels

   (4) difference of pressure between two points in a pipe

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6. Maximum fluctuation of energy in a flywheel is equal to _____ (notations have their usual meanings).

   (1) $I\omega(\omega_1 - \omega_2)$ (2) $I\omega^2 C_s$ (3) $2EC_s$ (4) All of these

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7. The mathematical technique for finding the best use of limited resources in an optim manner is known as :

(1) operation research (2) linear programming

(3) network analysis (4) queuing theory

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8. The loss of available energy associated with the transfer of 1000 kJ of heat from a constant temperature system at 600 K to another at 400 K when the environmental temperature is 300 K is :

(1) 166.67 kJ (2) 250 kJ (3) 500 kJ (4) 750 kJ

---

9. A ship whose hull length is 100 m is to travel at a speed of 10 m/sec. For dynamic similarity, at what velocity should a 1 : 25 model be towed through water ?

(1) 10 m/sec (2) 25 m/sec (3) 2 m/sec (4) 50 m/sec

---

10. The Gauss divergence theorem relates certain :

(1) surface integrals to line integrals

(2) vector quantities to other vector quantities

(3) line integrals to other volume integrals

(4) surface integrals to volume integrals

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11. Whirling speed of a shaft coincides with the natural frequency of the _____ vibration.

(1) longitudinal (2) transverse

(3) torsional (4) coupled between torsional

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12. In hot working process :

(1) Grain structure of the metal is refined.

(2) Porosity of the metal is largely eliminated.

(3) Mechanical properties are improved.

(4) All of the above

---

13. The lead time consumption is 500 units. The annual consumption is 8000 units. The company has a policy of EOQ ordering and maintenance of 200 units as safety stock. The reorder point (ROP) is :

(1) 500 units (2) 700 units (3) 200 units (4) None of these

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14. Gantt chart is used for :

(1) inventory control (2) material handling

(3) production schedule (4) m/c repair schedule

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15. Consider the differential equation $\frac{dy}{dt} = -2t + y$, with $y(0) = 3$. Take h = 0.1, using Euler's method $y(0.2)$ is approximately equal to :

(1) 3.610 (2) 3.510 (3) 3.410 (4) None of these

---

16. Two metallic blocks having masses in the ratio 2 : 3 are made to slide down a frictionless inclined plane starting initially from rest position. When these blocks reach the bottom of the inclined plane, they will have their kinetic energies in the ratio :

(1) 2 : 3 (2) 3 : 5 (3) 3 : 2 (4) 7 : 4

---

17. For which of the following situations, zeroth law of thermodynamics will **not** be valid ?

(1) 50 cc of water at 25° C is mixed with 150 cc of water at 25° C.

(2) 500 cc of milk at 15° C is mixed with 100 cc of water at 15° C.

(3) 5 kg of wet steam at 100° C is mixed with 50 kg of dry and saturated steam at 100° C.

(4) 10 cc of water at 20° C is mixed with 10 cc of sulphuric acid at 20° C.

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18. A particle is of weight 8 kg. When it is allowed to fall under the force of gravity its momentum at the time $t = 2$ sec would be _____ kg sec.

(1) 2 (2) 8 (3) 16 (4) 32

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19. The function of the washer is to :

(1) fill up the axial gap (2) provide bearing area

(3) provide cushioning effect (4) absorb shocks and vibration

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20. Queuing theory is associated with :

(1) inventory (2) sales

(3) waiting time (4) production time

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21. In a weaving operation, the parameter to be controlled is the number of defects per 10 square yards of material. Control chart appropriate for this task is :

(1) P-chart (2) C-chart (3) R-chart (4) X-chart

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22. In a single slider crank chain :

(1) each of the four pairs are a turning pair

(2) one is turning pair and three are sliding pairs

(3) two are turning pairs and two are sliding pairs

(4) three are turning pairs and one is a sliding pair

---

23. A critical activity has _____ slack.

(1) maximum (2) minimum (3) zero (4) average

---

24. Match the following :

(a)	$P(\phi)$, ϕ is the empty set	(i)	$1 - P(A)$
(b)	$P(A/B)$. $P(B)$	(ii)	$P(A \cap B)$
(c)	$P(\overline{A})$	(iii)	$1-P(A \cup B)$
(d)	$P(\overline{A} \cap \overline{B})$	(iv)	0
(e)	$P(A \cup B)$	(v)	$P(A) + P(B) - P(A \cap B)$

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

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25. A pressure of 500 kPa applied to a 2 m^3 if the liquid results in a volume change of 0.004 m^3, the bulk modulus in MPa is :

(1) 2.5 (2) 25 (3) 250 (4) 2500

---

26. A mass m attached to a light spring oscillates with a period of 2 seconds. If the mass is increased by 2 kg, the period increases by 1 second. The value of m is :

(1) 1 kg (2) 1.6 kg (3) 2 kg (4) 2.4 kg

---

27. Air enters a counter flow heat exchanger at 70°C and leaves at 40°C. Water enters at 30°C and leaves at 50°C. The Logarithmic Mean Temperature Difference (LMTD) in °C is :

(1) 5.65 (2) 14.43 (3) 19.52 (4) 20.17

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28. In the above example the heat generated due to friction is _____W.

(1) 2146 (2) 2248 (3) 2356 (4) 2474

29. The cutting tool in a milling machine is mounted on :

(1) spindle (2) arbor (3) column (4) knee

30. It is desired to punch a hole of 20 mm diameter in a plate of 20 mm thick. If the shear stress of mild steel is 30 kg/mm^2, the force necessary for punching would be approximately in the range of :

(1) 15-20 tonnes (2) 20-25 tonnes (3) 25-35 tonnes (4) 35-40 tonnes

31. The value of $\left[\lim_{x \to \infty}\left(\frac{1}{\sin x} - \frac{1}{\tan x}\right)\right]$ is :

(1) 0 (2) 1 (3) 2 (4) ∞

32. The value of $\frac{C_p}{C_v}$ for air is :

(1) 1 (2) 1.4 (3) 1.8 (4) 2.3

33. A shaft subjected to maximum bending stress of 80 N/mm^2 and maximum shearing stress equal to 30 N/mm^2 at a particular section. If the yield point in tension of the material is 280 N/mm^2 and maximum shear stress theory of failure is used, then the factor of safety obtained will be :

(1) 2.5 (2) 2.8 (3) 3.0 (4) 3.5

34. A particle is performing SHM. If its maximum velocity is 1.5 m/sec and its maximum acceleration is 12 m/sec^2 the frequency of motion would be _____ Hz.

(1) $16/\pi$ (2) $4/\pi$ (3) $2/\pi$ (4) $1/\pi$

35. A PERT activity has an optimistic time of three days, pessimistic time of 15 days and the expected time is 7 days. The most likely time of the activity is :

(1) 5 days (2) 6 days (3) 7 days (4) 9 days

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36. Match **List I** with **List II** :

	List I		List II
(a)	Aluminium brake shoe	(i)	Deep drawing
(b)	Plastic water bottle	(ii)	Blow moulding
(c)	Stainless steel cups	(iii)	Sand casting
(d)	Aluminium can	(iv)	Centrifugal casting
		(v)	Impact extrusion
		(vi)	Upset forging

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

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37. A single point tool has :

(1) rake angle (2) cutting angle (3) lip angle (4) All of these

---

38. Which of the following is the **correct** statement ?

(1) A stationary point on the graph is any point at which $\frac{dy}{dx} = 0$.

(2) A stationary point on the graph is any point at which $\frac{dy}{dx} = \infty$.

(3) A stationary point on the graph is any point at which there are gaps or breaks.

(4) None of these

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39. A screw is specified by its :

(1) major diameter and pitch (2) minor diameter and pitch

(3) pitch diameter (4) major diameter and minor diameter

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40. Match **List 1** with **List 2** :

	List 1		**List 2**
(a)	Helical gear	(i)	Non-interchangeable
(b)	Herring bones gear	(ii)	Zero axial thrust
(c)	Worm gears	(iii)	Quiet motion
(d)	Hypoid gears	(iv)	High speed reduction

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

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41. The rank of the matrix $\begin{bmatrix} 0 & 1 & 2 & -2 \\ 4 & 0 & 2 & 5 \\ 2 & 1 & 3 & 1 \end{bmatrix}$ is :

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

---

42. The process of improving the cutting action of the grinding wheel is called :

(1) truing (2) dressing (3) facing (4) clearing

---

43. If $A = \begin{bmatrix} \alpha & 2 \\ 2 & \alpha \end{bmatrix}$, $|A^3| = 125$, then α is :

(1) 7 (2) 5 (3) 3 (4) None of these

---

44. The order of error in the Simpson's rule for numerical integration with a step size h is :

(1) h (2) h^5 (3) h^3 (4) h^4

---

45. A body weighing 500 kg falls 8 cm and strikes a 500 kg/cm spring. The deformation of the spring will be _____ cm.

(1) 8 (2) 2 (3) 20 (4) 4

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46. The ratio of the ultimate stress to the design stress is known as :

(1) elastic limit (2) strain

(3) factor of safety (4) bulk modulus

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47. A bicycle remains stable in running through a bend because of :

(1) Coriolis action (2) Radius of curved path

(3) Gyroscopic and centrifugal action (4) None of the above

---

48. When a gas is heated, change takes place in :

(1) pressure (2) volume (3) temperature (4) All of these

---

49. If the particles of a fluid attain such velocities that vary from point to point in magnitude and direction as well as from instant, the flow is :

(1) Uniform (2) Steady (3) Turbulent (4) Laminar

---

50. Resistance spot welding is performed on two plates of 1.5 mm thickness with 6 mm diameter electrode, using 15000 A current for a time duration of 0.25 sec. Assuming the interface resistance to be 0.0001 ohm, the heat generated to form the weld is :

(1) 5625 W-sec (2) 8437 W-sec (3) 22500 W-sec (4) 33750 W-sec

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51. Inverse Laplace of $f(s) = \dfrac{s + 29}{(s + 4)\left(s^2 + 9\right)}$ is :

(1) $e^{-4t} - \cos 3t + \dfrac{5}{3}\sin 3t$ (2) $2e^{t} - e^{-2t} + 5e^{3t}$

(3) $2e^{-t} + e^{-2t} + 5e^{3t}$ (4) $4e^{-t} - e^{-2t} + 5e^{-3t}$

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52. Which of the following best describes a pick-and-place manipulator ?

(1) mainly used for large parts handling

(2) capable of point to point operation

(3) most flexible of all robots

(4) an intelligent robot

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53. A mass of 1 kg is attached to the end of a spring with stiffness 0.7 N/mm. The critical damping co-efficient of this system will be _____ Ns/m.

(1) 1.40 (2) 18.522 (3) 52.92 (4) 529.2

54. A lot has 10% defective items. Ten items are chosen randomly from this lot. The probability that exactly 2 of the chosen items are defective is :

(1) 0.0036 (2) 0.1937 (3) 0.2234 (4) 0.3874

55. A reversed Carnot cycle removes 40,000 W from a heat sink. The temperature of the heat sink is 260 K and the temperature of the heat reservoir is 320 K. The COP of the engine is :

(1) 2.33 (2) 3.33 (3) 4.33 (4) 5.33

56. Match the following **components** with the appropriate machining **processes** :

	Component		**Process**
(a)	Square hole in a high strength alloy	(i)	Milling
(b)	Square hole in a ceramic component	(ii)	Drilling
(c)	Blind holes in a die	(iii)	ECM
(d)	Turbine blade profile on a high strength alloy	(iv)	Jig boring
		(v)	EDM
		(vi)	USM

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

57. In an ideal gas turbine plant, it is assumed that the compression and expansion processes are :

(1) isothermal (2) isentropic (3) isobaric (4) None of these

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58. A number of cold rolling passes are required in a two high rolling mill to reduce the thickness of a plate from 50 mm to 25 mm. The roll diameter is 700 mm and the coefficient of friction at roll work interface is 0.1. It is required that the draft in each pass must be the same. Assuming no front and back tension, the minimum number of passes required will be :

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

---

59. The difference between the tooth space and the tooth thickness as measured on the pitch circle is called :

(1) working depth (2) clearance (3) face width (4) backlash

---

60. During air conditioning of a space the sensible heat added is 100 kcal/sec and the latent heat added is 50 kcal/sec, then the sensible heat factor is :

(1) 0.25 (2) 0.33 (3) 0.50 (4) 0.67

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61. A milling cutter having 8 teeth is rotating at 150 rpm. If the feed per tooth is 0.1, the table speed in mm per minute is :

(1) 120 (2) 187 (3) 125 (4) 70

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62. Mark the **false** statement :

(1) If $f(z)$ is bounded for all z in the entire complex plane, then $f(z)$ is a constant.

(2) If $f(z)$ is analytic inside a circle having its centre at $z = a$, then $|f'(a)|$ is bounded.

(3) If $u(x, y)$ is harmonic in D, then it has partial derivatives of all orders.

(4) If $f(z)$ is analytic inside the circle C having its centre at $z = a$, then $f(a)$ is the mean value of $f(z)$ on C.

---

63. The atomic mass of oxygen is :

(1) 12 (2) 14 (3) 16 (4) 32

---

64. In value engineering, the term value refers to :

(1) manufacturing cost of the product

(2) selling price of the product

(3) total cost of the product

(4) utility of the product

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65. Reynold's number is the ratio of inertia force to :

(1) pressure force (2) elastic force

(3) gravity force (4) viscous force

---

66. The maximum velocity of a body in SHM with amplitude of 150 mm and a frequency of 2 vibrations/sec is equal to _____ m/sec.

(1) 0.01885 (2) 0.1885 (3) 1.885 (4) 18.55

---

67. A ball A of mass 0.25 kg moving on a smooth horizontal table with a velocity of 10 m/sec strikes an identical stationary ball B on the table. If the impact is perfectly plastic, the velocity of the ball B just after the impact will be :

(1) 5 m/sec (2) 10 m/sec (3) zero (4) 2.5 m/sec

---

68. A counter flow shell and tube exchanger is used to heat water with hot exhaust gases. The water (C = 4180 J/kg °C) flows at a rate of 2 kg/s while the exhaust gas (1030 J/kg °C) flows at the rate of 5.25 kg/s. If the heat transfer surface area is 32.5 m^2 and the overall heat transfer coefficient is 200 W/m^2 °C, what is the NTU for the heat exchanger ?

(1) 1.2 (2) 2.4 (3) 4.5 (4) 8.6

---

69. Air at 20° C blows over a plate of 50 cm × 75 cm maintained at 250°C. If the convection heat transfer coefficient is 25 W/m^2 °C, the heat transfer rate is _____ kW.

(1) 215.6 (2) 2156 (3) 2.156 (4) 21.56

---

70. If $F = 2xz\hat{i} - x\hat{j} + y^2\hat{k}$ and V is the region bounded by surface $x = 0, x = 2, y = 0, y = 6, z = x^2, z = 4$ then $\iiint_V F dV$ is :

(1) $2\hat{i} - 3\hat{j} + 4\hat{k}$ (2) $28\hat{i} - 24\hat{j} + 284\hat{k}$

(3) $9\hat{i} + 200\hat{j} + 64\hat{k}$ (4) None of these

---

71. A 150 mm diameter shaft supporting a load of 10 kN has a speed of 1500 rpm. The shaft runs in a bearing whose length is 1.5 times the shaft diameter. The coefficient of friction is 0.02. The bearing pressure is _____ N/mm^2.

(1) 0.24 (2) 0.296 (3) 0.34 (4) 0.46

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P.T.O.

72. Arrival to a system is Poisson with mean rate of 6 per hour, and service time of 3 mi The expected queue length will be :

(1) 0.3 (2) 0.129 (3) 1.29 (4) 12.9

---

73. The specific gravity of water is taken as :

(1) 0.001 (2) 0.01 (3) 0.1 (4) 1

---

74. Match the **measuring instruments** with the appropriate **applications** :

	Measuring instruments		**Applications**
(a)	Talysurf	(i)	T-slots
(b)	Telescopic gauge	(ii)	Flatness
(c)	Transfer calipers	(iii)	Internal diameter
(d)	Autocollimator	(iv)	Roughness

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

---

75. A 750 hours life test is performed on ten components. If one component fails after 350 hours of operation and all other survive the test, then the failure per hour is :

(1) 0.000141 (2) 0.000133 (3) 0.00141 (4) 0.00133

---

76. Integrals $f(x, y) = x/y$ over the region bounded by $y = x$, $y = 2x$, $x = 1$, $x = 2$ in the first quadrant is :

(1) $3\ ln\ 2$ (2) 3 (3) $\frac{3}{2}\ ln\ 2$ (4) None of these

---

77. A framed structure is imperfect, if the number of members are _____ $(2j - 3)$, where j is the number of joints.

(1) equal to (2) less than (3) greater than (4) either (2) or (3)

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78. The Euler load for a column is 1000 kN and crushing load is 1500 kN. The Rankine load is equal to :

(1) 600 kN (2) 1000 kN (3) 1500 kN (4) 2500 kN

---

79. An insulated 2 kg box falls from a balloon 3.5 km above the earth. The change in the internal energy of the box after it has hit the earth's surface will be :

(1) zero (2) 70,000 kJ (3) 68.6 kJ (4) 7 kJ

---

80. The difference between tensions on the tight and slack sides of the belt drive is 3000 N. If the belt speed is 15 m/sec, the transmitted power in kW is :

(1) 45 (2) 22.5 (3) 90 (4) 100

- o 0 o -

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सूचना — (पृष्ठ 1 वरून पुढे....)

(8) प्रश्नपुस्तिकेमध्ये विहित केलेल्या विशिष्ट जागीच कच्चे काम (रफ वर्क) करावे. प्रश्नपुस्तिकेव्यतिरिक्त उत्तरपत्रिकेवर वा इतर कागदावर कच्चे काम केल्यास ते कॉपी करण्याच्या उद्देशाने केले आहे, असे मानले जाईल व त्यानुसार उमेदवारावर शासनाने जारी केलेल्या "परीक्षांमध्ये होणाऱ्या गैरप्रकारांना प्रतिबंध करण्याबाबतचे अधिनियम-82" यातील तरतुदीनुसार कारवाई करण्यात येईल व दोषी व्यक्ती कमाल एक वर्षाच्या कारावासाच्या आणि/किंवा रुपये एक हजार रकमेच्या दंडाच्या शिक्षेस पात्र होईल.

(9) सदर प्रश्नपत्रिकेसाठी आयोगाने विहित केलेली वेळ संपल्यानंतर उमेदवाराला ही प्रश्नपुस्तिका स्वत:बरोबर परीक्षाकक्षाबाहेर घेऊन जाण्यास परवानगी आहे. **मात्र परीक्षा कक्षाबाहेर जाण्यापूर्वी उमेदवाराने आपल्या उत्तरपत्रिकेचा भाग-1 समवेक्षकाकडे न विसरता परत करणे आवश्यक आहे.**

नमुना प्रश्न

Pick out the correct word to fill in the blank :

Q. No. 201. I congratulate you _____ your grand success.

(1) for (2) at (3) on (4) about

ह्या प्रश्नाचे योग्य उत्तर "(3) on" असे आहे. त्यामुळे या प्रश्नाचे उत्तर "(3)" होईल. यास्तव खालीलप्रमाणे प्रश्न क्र. 201 समोरील उत्तर-क्रमांक "③" हे वर्तुळ पूर्णपणे छायांकित करून दाखविणे आवश्यक आहे.

प्र. क्र. 201. ① ② ● ④

अशा पद्धतीने प्रस्तुत प्रश्नपुस्तिकेतील प्रत्येक प्रश्नाचा तुमचा उत्तरक्रमांक हा तुम्हाला स्वतंत्ररीत्या पुरविलेल्या उत्तरपत्रिकेवरील त्या त्या प्रश्नक्रमांकासमोरील संबंधित वर्तुळ पूर्णपणे छायांकित करून दाखवावा. **ह्याकरिता फक्त काळ्या शाईचे बॉलपेन वापरावे, पेन्सिल वा शाईचे पेन वापरू नये.**

कच्च्या कामासाठी जागा /SPACE FOR ROUGH WORK