Set Code : T2

Booklet Code : A

Note: *(1) Answer **all** questions.*

*(2) Each question carries **1** mark. There are no negative marks.*

(3) Answer to the questions must be entered only on OMR Response Sheet provided separately by completely shading with H.B. Pencil, only one of the circles 1, 2, 3 or 4 provided against each question, and which is most appropriate to the question.

(MEC)

MECHANICAL ENGINEERING

INSTRUCTIONS TO CANDIDATES

1. Candidates should write their Hall Ticket Number only in the space provided at the top left hand corner of this page, on the leaflet attached to this booklet and also in the space provided on the OMR Response Sheet. **BESIDES WRITING, THE CANDIDATE SHOULD ENSURE THAT THE APPROPRIATE CIRCLES PROVIDED FOR THE HALL TICKET NUMBERS ARE SHADED USING H.B. PENCIL ONLY ON THE OMR RESPONSE SHEET. DO NOT WRITE HALL TICKET NUMBER ANY WHERE ELSE.**
2. Immediately on opening this Question Paper Booklet, check:
   (a) Whether **200** multiple choice questions are printed (**50** questions in Mathematics, **25** questions in Physics, **25** questions in Chemistry and **100** questions in Engineering)
   (b) In case of any discrepancy immediately exchange the Question paper Booklet of same code by bringing the error to the notice of invigilator.
3. Use of Calculators, Mathematical Tables and Log books is not permitted.
4. **Candidate must ensure that he/she has received the Correct Question Booklet, corresponding to his/her branch of Engineering.**
5. **Candidate should ensure that the booklet Code and the Booklet Serial Number, as it appears on this page is entered at the appropriate place on the OMR Response Sheet by shading the appropriate circles provided therein using H.B. pencil only. Candidate should note that if they fail to enter the Booklet Serial Number and the Booklet Code on the OMR Response Sheet, their Answer Sheet will not be valued.**
6. **Candidate shall shade one of the circles 1, 2, 3 or 4 corresponding question on the OMR Response Sheet using H.B. Pencil only. Candidate should note that their OMR Response Sheet will be invalidated if the circles against the question are shaded using Black / Blue ink pen / Ball pen / any other pencil other than H.B. Pencil or if more than one circle is shaded against any question.**
7. One mark will be awarded for every correct answer. **There are no negative marks.**
8. The OMR Response Sheet will not be valued if the candidate :
   (a) Writes the Hall Ticket Number in any part of the OMR Response Sheet except in the space provided for the purpose.
   (b) Writes any irrelevant matter including religious symbols, words, prayers or any communication whatsoever in any part of the OMR Response Sheet.
   (c) Adopts any other malpractice.
9. Rough work should be done only in the space provided in the Question Paper Booklet.
10. No loose sheets or papers will be allowed in the examination hall.
11. Timings of Test: 10.00 A.M. to 1.00 P.M.
12. Candidate should ensure that he / she enters his / her name and appends signature on the Question paper booklet, leaflet attached to this question paper booklet and also on the OMR Response Sheet in the space provided. Candidate should ensure that the invigilator puts his signature on this question paper booklet, leaflet attached to the question paper booklet and also on the OMR Response Sheet.
13. Before leaving the examination hall candidate should **return both the OMR Response Sheet and the leaflet attached to this question paper booklet** to the invigilator. Failure to return any of the above shall be construed as malpractice in the examination. **Question paper booklet may be retained by the candidate.**
14. This booklet contains a total of **32** pages including Cover page and the pages for Rough Work.

Set Code : T2
Booklet Code : A

Note: *(1) Answer **all** questions.*
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(3) Answer to the questions must be entered only on OMR Response Sheet provided separately by completely shading with H.B. Pencil, only one of the circles 1, 2, 3 or 4 provided against each question, and which is most appropriate to the question.
(4) The OMR Response Sheet will be invalidated if the circle is shaded using ink / ball pen or if more than one circle is shaded against each question.

MATHEMATICS

1. If $A=\begin{bmatrix}3&0&0\\0&3&0\\0&0&3\end{bmatrix}$, then $A^4=$

(1) 3I (2) 9I (3) 27I (4) 81I

2. If $A=\begin{bmatrix}0&2&1\\-2&0&-2\\-1&x&0\end{bmatrix}$ is a skew symmetric matrix, then the value of x is

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

3. What is the number of all possible matrices with each entry as 0 or 1 if the order of matrices is 3×3

(1) 64 (2) 268 (3) 512 (4) 256

4. If $A=\begin{bmatrix}1&i&-i\\i&-i&1\\-i&1&i\end{bmatrix}$, then $|A|=$

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

5. The solution of a system of linear equations $2x-y+3z=9, x+y+z=6, x-y+z=2$ is
   (1) $x=-1, y=-2, z=-3$ (2) $x=3, y=2, z=1$
   (3) $x=2, y=1, z=3$ (4) $x=1, y=2, z=3$

6. If $\frac{1}{x^2+a^2}=\frac{A}{x+ai}+\frac{B}{x-ai}$ then A = _____, B = _____.
   (1) $\frac{1}{2ai}, -\frac{1}{2ai}$ (2) $-\frac{1}{2ai}, \frac{1}{2ai}$ (3) $\frac{1}{ai}, -\frac{1}{ai}$ (4) $-\frac{1}{ai}, \frac{1}{ai}$

7. If $\frac{2x+4}{(x-1)^3}=\frac{A_1}{(x-1)}+\frac{A_2}{(x-1)^2}+\frac{A_3}{(x-1)^3}$ then $\sum_{i=1}^{3} A_i$ is equal to
   (1) A_2 (2) $2A_2$ (3) $4A_2$ (4) $4A_1$

8. The period of the function $f(x) = |\sin x|$ is
   (1) π (2) 2π (3) 3π (4) 4π

9. If A+B=45°, then (1−cotA) . (1−cotB) is
   (1) 1 (2) 0 (3) 2 (4) −1

10. The value of sin 78° + cos 132° is
    (1) $\frac{\sqrt{5}+1}{4}$ (2) $\frac{\sqrt{5}+1}{2}$ (3) $\frac{\sqrt{5}-1}{2}$ (4) $\frac{\sqrt{5}-1}{4}$

11. If A+B+C = π, then sin2A + sin2B + sin2C =
    (1) 4 cosA sinB cosC (2) 4 sinA cosB sinC
    (3) 4 cosA cosB cosC (4) 4 sinA sinB sinC

12. The principal solution of Tanx = 0 is
    (1) $x = n\pi, n\in Z$ (2) $x=0$
    (3) $x=(2n+1)\,\pi/2, n\in Z$ (4) $x = n\pi+\alpha, n\in Z$

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13. The value of $\text{Tan}^{-1}(2) + \text{Tan}^{-1}(3)$ is
(1) $\frac{\pi}{4}$ (2) $\frac{\pi}{2}$ (3) $\frac{\pi}{3}$ (4) $\frac{3\pi}{4}$

14. If the sides of a right angle triangle are in A.P., then the ratio of its sides is
(1) 1:2:3 (2) 2:3:4 (3) 3:4:5 (4) 4:5:6

15. The value of $r.r_1.r_2.r_3$ is
(1) Δ^2 (2) Δ^{-2} (3) Δ^{-3} (4) Δ^4

16. $\frac{1}{r1}+\frac{1}{r2}+\frac{1}{r3}=$
(1) $\frac{1}{r}$ (2) $\frac{1}{2r}$ (3) $\frac{1}{R}$ (4) $\frac{1}{\Delta}$

17. If $a=6$, $b=5$, $c=9$, then the value of angle A is
(1) $\cos^{-1}(2/9)$ (2) $\cos^{-1}(2/5)$ (3) $\cos^{-1}(7/9)$ (4) $\cos^{-1}(1/3)$

18. The polar form of complex number $1-i$ is
(1) $\sqrt{2}e^{-i\pi/4}$ (2) $\sqrt{2}e^{i\pi/4}$ (3) $\sqrt{2}e^{i\pi/2}$ (4) $\sqrt{2}e^{-i\pi/2}$

19. If 1, ω, ω^2 be the cube roots of unity, then the value of $2^{\omega^3}.2^{\omega^5}.2^{\omega}$ is
(1) ω (2) ω^2 (3) 1 (4) 0

20. The intercept made on X-axis by the circle $x^2+y^2+2gx+2fy+c=0$ is
(1) $\sqrt{g^2-c}$ (2) $\sqrt{f^2-c}$ (3) $2.\sqrt{g^2-c}$ (4) $2.\sqrt{f^2-c}$

21. If one end of the diameter of the circle $x^2+y^2-5x-8y+13=0$ is (2, 7), then the other end of the diameter is
(1) (3, 1) (2) (1, 3) (3) (–3, –1) (4) (–1, –3)

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22. The radius of the circle $\sqrt{1+m^2}(x^2+y^2)-2cx-2mcy=0$ is
(1) $2c$ (2) $4c$ (3) $c/2$ (4) c

23. The parametric equations of the ellipse $\frac{x^2}{a^2}+\frac{y^2}{b^2}=1$ are
(1) $x=a\sec\theta, y=b\tan\theta$ (2) $x=b\sin\theta, y=a\cos\theta$
(3) $x=a\cos\theta, y=b\sin\theta$ (4) $x=a\operatorname{cosec}\theta, y=b\cot\theta$

24. The equation of the directrix of the parabola $2x^2=-7y$ is
(1) $8y+7=0$ (2) $8y-7=0$ (3) $7y+8=0$ (4) $8x-7=0$

25. The condition for a straight line $y=mx+c$ to be a tangent to the hyperbola $\frac{x^2}{a^2}-\frac{y^2}{b^2}=1$ is
(1) $c=a/m$ (2) $c^2=a^2m^2-b^2$ (3) $c^2=a^2m^2+b^2$ (4) $c^2=a/m$

26. $\lim\limits_{x\to 1}\frac{\sqrt{5x-4}-\sqrt{x}}{x-1}$ is
(1) 3 (2) 2 (3) 4 (4) 1

27. $\log i =$
(1) $\pi/2$ (2) $\pi/4$ (3) $i\pi/2$ (4) $i\pi/4$

28. $\frac{d}{dx}[\log_7 X]=$
(1) $\frac{1}{x}$ (2) $X\log_7^e$ (3) $\frac{1}{x}\log_e^7$ (4) $\frac{1}{x}\log_7^e$

29. $\frac{d}{dx}[2\cosh x]=$
(1) $\frac{e^x+e^{-x}}{2}$ (2) $\frac{e^x-e^{-x}}{2}$ (3) e^x+e^{-x} (4) e^x-e^{-x}

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30. $\frac{d}{dx}\left[\cos^{-1}\left(\frac{1-x^2}{1+x^2}\right)\right]=$

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

31. If $x = at^2, y = 2at$, then $\frac{dy}{dx}=$

(1) $\sqrt{\frac{y}{x}}$ (2) $\sqrt{\frac{x}{a}}$ (3) $\sqrt{\frac{a}{x}}$ (4) $\sqrt{\frac{x}{y}}$

32. The derivative of e^x with respect to $\sqrt{x}$ is

(1) $\frac{2\sqrt{x}}{e^x}$ (2) $2\sqrt{x}\,e^x$ (3) $\frac{e^x}{2\sqrt{x}}$ (4) $\sqrt{x}.e^x$

33. The equation of the normal to the curve $y = 5x^4$ at the point (1, 5) is

(1) $x + 20y = 99$ (2) $x + 20y = 101$ (3) $x - 20y = 99$ (4) $x - 20y = 101$

34. The angle between the curves $y^2 = 4x$ and $x^2 + y^2 = 5$ is

(1) $\frac{\pi}{4}$ (2) $\tan^{-1}(2)$ (3) $\tan^{-1}(3)$ (4) $\tan^{-1}(4)$

35. If $u = x^3y^3$ then $\frac{\partial^3 u}{\partial x^3}+\frac{\partial^3 u}{\partial y^3}=$

(1) $6\,(x^3+y^3)$ (2) $6\,x^3\,y^3$ (3) $6x^3$ (4) $6y^3$

36. $\int \text{cosec}\, x\, dx=$

(1) $\log(\text{cosec}\, x + \cot x) + C$ (2) $\log(\cot x/2) + C$
(3) $\log(\tan x/2) + C$ (4) $-\text{cosec}\, x.\cot x + C$

Set Code : T2
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37. $\int_0^{\frac{\pi}{2}} \cos^{11} x \, dx =$

(1) $\frac{256}{693}$ (2) $\frac{256\pi}{693}$ (3) $\frac{\pi}{4}$ (4) $\frac{128}{693}$

38. $\int f^1(x).[f(x)]^n dx =$

(1) $\frac{[f(x)]^{n-1}}{n-1}+C$ (2) $\frac{[f(x)]^{n+1}}{n+1}+C$ (3) $n[f(x)]^{n-1}+C$ (4) $(n+1)[f(x)]^{n+1}+C$

39. $\int \frac{dx}{(x+7)\sqrt{x+6}} =$

(1) $Tan^{-1}(\sqrt{x+6})+C$ (2) $2Tan^{-1}(\sqrt{x+6})+C$

(3) $Tan^{-1}(x+7)+C$ (4) $2Tan^{-1}(x+7)+C$

40. $\int \tan^{-1} x \, dx =$

(1) $x.Tan^{-1}x+\frac{1}{2}\log(1+x^2)+C$ (2) $\frac{1}{1+x^2}+C$

(3) $x^2.Tan^{-1}x+C$ (4) $x.Tan^{-1}x-\log\sqrt{1+x^2}+C$

41. $\int \frac{dx}{1+e^{-x}} =$

(1) $\log(1+e^{-x})+C$ (2) $\log(1+e^{x})+C$

(3) $e^{-x}+C$ (4) $e^{x}+C$

42. $\int_{\frac{-\pi}{2}}^{\frac{\pi}{2}} \sin|x| \, dx =$

(1) 0 (2) 1 (3) 2 (4) -1

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43. Area under the curve $f(x) = \sin x$ in $[0, \pi]$ is
(1) 4 sq. units (2) 2 sq. units (3) 6 sq. units (4) 8 sq. units

44. The order of $x^3\frac{d^3y}{dx^3} + 2x^2\frac{d^2y}{dx^2} - 3y = x$ is
(1) 1 (2) 4 (3) 3 (4) 2

45. The degree of $\left[\frac{d^2y}{dx^2} + \left(\frac{dy}{dx}\right)^2\right]^{\frac{3}{2}} = a\frac{d^2y}{dx^2}$ is
(1) 4 (2) 2 (3) 1 (4) 3

46. The family of straight lines passing through the origin is represented by the differential equation
(1) $ydx + xdy = 0$ (2) $xdy - ydx = 0$ (3) $xdx + ydy = 0$ (4) $xdx - ydy = 0$

47. The differential equitation $\frac{dy}{dx} + \frac{ax+hy+g}{hx+by+f} = 0$ is called
(1) Homogeneous (2) Exact (3) Linear (4) Legender

48. The solution of differential equation $\frac{dy}{dx} = e^{-x^2} - 2xy$ is
(1) $y.e^{-x^2} = x + c$ (2) $ye^x = x + c$ (3) $ye^{x^2} = x + c$ (4) $y = x + c$

49. The complementary function of $(D^3+D^2+D+1)y = 10$ is
(1) $C_1\cos x + C_2\sin x + C_3e^{-x}$ (2) $C_1\cos x + C_2\sin x + C_3e^x$
(3) $C_1 + C_2\cos x + C_3\sin x$ (4) $(C_1 + C_2x + C_3x^2)e^x$

50. Particular Integral of $(D-1)^4y = e^x$ is
(1) x^4e^x (2) $\frac{x^4}{24}e^{-x}$ (3) $\frac{x^4}{12}e^x$ (4) $\frac{x^4}{24}e^x$

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PHYSICS

51. Two quantities A and B are related by the relation A/B = m where m is linear mass density and A is force. The dimensions of B will be
(1) same as that of latent heat (2) same as that of pressure
(3) same as that of work (4) same as that of momentum

52. The dimensional formula of capacitance in terms of M, L, T and I is
(1) $[ML^2T^2I^2]$ (2) $[ML^{-2}T^4I^2]$ (3) $[M^{-1}L^3T^3I]$ (4) $[M^{-1}L^{-2}T^4I^2]$

53. If l, m and n are the direction cosines of a vector, then
(1) $l+m+n=1$ (2) $l^2+m^2+n^2=1$ (3) $\frac{1}{l}+\frac{1}{m}+\frac{1}{n}=1$ (4) $lmn=1$

54. The angle between i+j and j+k is
(1) 0° (2) 90° (3) 45° (4) 60°

55. A particle is moving eastwards with a velocity of 5 ms^{-1}. In 10 seconds the velocity changes to 5 ms^{-1} northwards. The average acceleration in this time is
(1) $\frac{1}{\sqrt{2}}$ ms^{-2} towards north-west (2) zero
(3) $\frac{1}{2}$ ms^{-2} towards north (4) $\frac{1}{\sqrt{2}}$ ms^{-2} towards north-east

56. The linear momentum of a particle varies with time t as $p=a+bt+ct^2$ which of the following is correct?
(1) Force varies with time in a quadratic manner.
(2) Force is time-dependent.
(3) The velocity of the particle is proportional to time.
(4) The displacement of the particle is proportional to t.

57. A shell of mass m moving with a velocity v suddenly explodes into two pieces. One part of mass $m/4$ remains stationary. The velocity of the other part is
(1) v (2) $2v$ (3) $3v/4$ (4) $4v/3$

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58. The velocity of a freely falling body after 2s is
(1) 9.8 ms^{-1} (2) 10.2 ms^{-1} (3) 18.6 ms^{-1} (4) 19.6 ms^{-1}

59. A large number of bullets are fired in all directions with the same speed u. The maximum area on the ground on which these bullets will spread is
(1) $\frac{\pi u^2}{g^2}$ (2) $\frac{\pi u^4}{g^2}$ (3) $\frac{\pi u^2}{g^4}$ (4) $\frac{\pi u}{g^4}$

60. The minimum stopping distance for a car of mass m, moving with a speed v along a level road, if the coefficient of friction between the tyres and the road is μ, will be
(1) $\frac{v^2}{2\mu g}$ (2) $\frac{v^2}{\mu g}$ (3) $\frac{v^2}{4\mu g}$ (4) $\frac{v}{2\mu g}$

61. When a bicycle is in motion, the force of friction excreted by the ground on the two wheels is such that it acts
(1) In the backward direction on the front wheel and in the forward direction on the rear wheel
(2) In the forward direction on the front wheel and in the backward direction on the rear wheel
(3) In the backward direction on both the front and the rear wheels
(4) In the forward direction on both the front and the rear wheels

62. In a perfectly inelastic collision, the two bodies
(1) strike and explode (2) explode without striking
(3) implode and explode (4) combine and move together

63. Under the action of a constant force, a particle is experiencing a constant acceleration, then the power is
(1) zero (2) positive
(3) negative (4) increasing uniformly with time

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64. Consider the following two statements:
A: Linear momentum of a system of particles is zero.
B: Kinetic energy of a system of particles is zero.
Then
(1) A implies B & B implies A
(2) A does not imply B & B does not imply A
(3) A implies B but B does not imply A
(4) A does not imply B but B implies A

65. An engine develops 10 kW of power. How much time will it take to lift a mass of 200 kg to a height of 40 m? (Given g = 10 ms^{-2})
(1) 4s (2) 5s (3) 8s (4) 10s

66. If a spring has time period T, and is cut into *n* equal parts, then the time period will be
(1) $T\sqrt{n}$ (2) $\frac{T}{\sqrt{n}}$ (3) nT (4) T

67. When temperature increases, the frequency of a tuning fork
(1) increases
(2) decreases
(3) remains same
(4) increases or decreases depending on the materials

68. If a simple harmonic motion is represented by $\frac{d^2x}{dy^2}+\alpha x=0$, its time period is
(1) $2\pi\sqrt{\alpha}$ (2) $2\pi\alpha$ (3) $\frac{2\pi}{\sqrt{\alpha}}$ (4) $\frac{2\pi}{\alpha}$

69. A cinema hall has volume of 7500 m^3. It is required to have reverberation time of 1.5 seconds. The total absorption in the hall should be
(1) 850 w-m^2 (2) 82.50 w-m^2 (3) 8.250 w-m^2 (4) 0.825 w-m^2

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70. To absorb the sound in a hall which of the following are used
(1) Glasses, stores (2) Carpets, curtains
(3) Polished surfaces (4) Platforms

71. If N represents avagadro's number, then the number of molecules in 6 gm of hydrogen at NTP is
(1) 2N (2) 3N (3) N (4) N/6

72. The mean translational kinetic energy of a perfect gas molecule at the temperature T K is
(1) $\frac{1}{2}kT$ (2) kT (3) $\frac{3}{2}kT$ (4) $2kT$

73. The amount of heat given to a body which raises its temperature by 1°C
(1) water equivalent (2) thermal heat capacity
(3) specific heat (4) temperature gradient

74. During an adiabatic process, the pressure of a gas is found to be proportional to the cube of its absolute temperature. The ratio Cp/Cv for gas is
(1) $\frac{3}{2}$ (2) $\frac{4}{3}$ (3) 2 (4) $\frac{5}{3}$

75. Cladding in the optical fiber is mainly used to
(1) to protect the fiber from mechanical stresses
(2) to protect the fiber from corrosion
(3) to protect the fiber from mechanical strength
(4) to protect the fiber from electromagnetic guidance

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CHEMISTRY

76. The valency electronic configuration of Phosphorous atom (At.No. 15) is
(1) $3s^2\ 3p^3$ (2) $3s^1\ 3p^3\ 3d^1$ (3) $3s^2\ 3p^2\ 3d^1$ (4) $3s^1\ 3p^2\ 3d^2$

77. An element 'A' of At.No.12 combines with an element 'B' of At.No.17. The compound formed is
(1) covalent AB (2) ionic AB_2 (3) covalent AB_2 (4) ionic AB

78. The number of neutrons present in the atom of $_{56}Ba^{137}$ is
(1) 56 (2) 137 (3) 193 (4) 81

79. Hydrogen bonding in water molecule is responsible for
(1) decrease in its freezing point (2) increase in its degree of ionization
(3) increase in its boiling point (4) decrease in its boiling point

80. In the HCl molecule, the bonding between hydrogen and chlorine is
(1) purely covalent (2) purely ionic (3) polar covalent (4) complex coordinate

81. Potassium metal and potassium ions
(1) both react with water (2) have the same number of protons
(3) both react with chlorine gas (4) have the same electronic configuration

82. 5.85 gms of sodium chloride were dissolved in water and the solution made upto 100 ml in a standard flask. 10 ml of this solution were pipetted out into another flask and made up with distilled water into 100 ml of solution. The concentration of the sodium chloride solution now is
(1) 0.1 M (2) 1.0 M (3) 0.5 M (4) 0.25 M

83. Concentration of a 1.0 M solution of phosphoric acid in water is
(1) 0.33 N (2) 1.0 N (3) 2.0 N (4) 3.0 N

84. Which of the following is a Lewis acid?
(1) Ammonia (2) Berylium chloride
(3) Boron trifluoride (4) Magnesium oxide

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85. Which of the following constitutes the components of a buffer solution?
(1) Potassium chloride and potassium hydroxide
(2) Sodium acetate and acetic acid
(3) Magnesium sulphate and sulphuric acid
(4) Calcium chloride and calcium acetate

86. Which of the following is an electrolyte?
(1) Acetic acid (2) Glucose (3) Urea (4) Pyridine

87. Calculate the Standard emf of the cell, $Cd/Cd^{+2}//Cu^{+2}/Cu$ given that $E^0\ Cd/Cd^{+2} = 0.44V$ and $E^0\ Cu/Cu^{+2} = (-)\ 0.34\ V$.
(1) (–) 1.0 V (2) 1.0 V (3) (–) 0.78 V (4) 0.78 V

88. A solution of nickel chloride was electrolysed using Platinum electrodes. After electrolysis,
(1) nickel will be deposited on the anode (2) Cl_2 gas will be liberated at the cathode
(3) H_2 gas will be liberated at the anode (4) nickel will be deposited on the cathode

89. Which of the following metals will undergo oxidation fastest?
(1) Cu (2) Li (3) Zinc (4) Iron

90. Which of the following cannot be used for the sterilization of drinking water?
(1) Ozone (2) Calcium Oxychloride
(3) Potassium Chloride (4) Chlorine water

91. A water sample showed it to contain 1.20 mg/litre of magnesium sulphate. Then, its hardness in terms of calcium carbonate equivalent is
(1) 1.0 ppm (2) 1.20 ppm (3) 0.60 ppm (4) 2.40 ppm

92. Soda used in the L-S process for softening of water is, Chemically.
(1) sodium bicarbonate (2) sodium carbonate decahydrate
(3) sodium carbonate (4) sodium hydroxide (40%)

93. The process of cementation with zinc powder is known as
(1) sherardizing (2) zincing (3) metal cladding (4) electroplating

94. Carrosion of a metal is fastest in
(1) rain-water (2) acidulated water (3) distilled water (4) de-ionised water

95. Which of the following is a thermoset polymer?
(1) Polystyrene (2) PVC
(3) Polythene (4) Urea-formaldehyde resin

96. Chemically, neoprene is
(1) polyvinyl benzene (2) polyacetylene
(3) polychloroprene (4) poly-1,3-butadiene

97. Vulcanization involves heating of raw rubber with
(1) selenium element (2) elemental sulphur
(3) a mixture of Se and elemental sulphur (4) a mixture of selenium and sulphur dioxide

98. Petrol largely contains
(1) a mixture of unsaturated hydrocarbons C_5 - C_8
(2) a mixture of benzene, toluene and xylene
(3) a mixture of saturated hydrocarbons C_{12} - C_{14}
(4) a mixture of saturated hydrocarbons C_6 - C_8

99. Which of the following gases is largely responsible for acid-rain?
(1) SO_2 & NO_2 (2) CO_2 & water vapour
(3) CO_2 & N_2 (4) N_2 & CO_2

100. BOD stands for
(1) Biogenetic Oxygen Demand (2) Biometric Oxygen Demand
(3) Biological Oxygen Demand (4) Biospecific Oxygen Demand

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MECHANICAL ENGINEERING

101. A mortise gauge is a
(1) planning tool (2) striking tool
(3) marking tool (4) boring tool

102. A saw which cuts wood during the return stroke of the saw is known as
(1) push saw (2) pull saw (3) rip saw (4) hand saw

103. In a shaper, tool head consist of
(1) clapper box (2) work holding device
(3) collet (4) four sided tool post

104. The swing diameter over the bed is _____ the height of the centre measured from the bed of the lathe.
(1) equal to (2) one and half times
(3) twice (4) thrice

105. The rake angle required to machine brass by HSS tool is
(1) 0° (2) 10° (3) 20° (4) –10°

106. The binding material used in cemented carbide tool is
(1) tungsten (2) chromium (3) silicon (4) cobalt

07. The relation between tool life(T) and cutting speed (V) is VT^n = constant. In this relation, the value of n depends upon
(1) work material (2) working conditions
(3) tool material (4) type of chip produced

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108. The usual value of the point angle of a drill is
(1) 60° (2) 80° (3) 112° (4) 118°

109. Drilling is an example of
(1) Orthogonal cutting (2) Oblique cutting
(3) Simple cutting (4) Uniform cutting

110. The top and sides of the table of a shaper usually have
(1) I-type slots (2) L-type slots (3) T-type slots (4) H-type slots

111. In lapping operation, the amount of thickness of metal removed is
(1) 0.005 to 0.01 mm (2) 0.01 to 0.1 mm
(3) 0.05 to 0.1 mm (4) 0.5 to 1 mm

112. The process of removing metal by a cutter which is rotated in the same direction of travel of work piece is called
(1) up milling (2) down milling (3) face milling (4) end milling

113. CNC drilling machine is considered to be
(1) P.T.P controlled machine (2) Continuous path controlled machine
(3) Servo controlled machine (4) Adaptive controlled machine

114. Seam welding is best adopted for metal thickness ranging from
(1) 0.025 to 3 mm (2) 3 to 5 mm (3) 5 to 8 mm (4) 8 to 10 mm

115. In welding, flux is used to
(1) improve melting point of metal (2) obtain high temperature
(3) mix the metal at joint (4) protect molten metal from atmosphere

Set Code : T2
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116. Acetelyne in gas welding process is obtained from
(1) calcium carbonate (2) potassium carbonate
(3) potassium carbide (4) calcium carbide

117. The electron beam welding can be carried out in
(1) a shielded gas environment (2) open air
(3) vacuum (4) a pressurized inert gas chamber

118. Following is the fusion type welding process
(1) submerged are welding process (2) explosive welding process
(3) friction welding process (4) diffusion welding process

119. In hot machining tool is made of
(1) tungsten carbide (2) brass
(3) diamond (4) stainless steel

120. The increase in hardness due to cold working is called
(1) age hardening (2) induction hardening
(3) work hardening (4) flame hardening

121. In die casting, machining allowance is
(1) small (2) large (3) very large (4) not provided

122. The draft allowance on casting is generally
(1) 1 to 2 cm/m (2) 2 to 5 cm/m (3) 5 to 10 cm/m (4) 10 to 15 cm/m

123. A casting defect which occurs near the ingates as rough lumps on the surface of a casting is known as
(1) shift (2) sand wash (3) swell (4) scab

124. In sand moulding process, cores are used to
(1) directional solidification (2) filling the cavities with molten metal
(3) to create the cavity in the casting (4) to minimize wastage of metal

125. The symbol used for butt resistance weld is
(1) ∩ (2) | (3) ⌂ (4) □

126. The roughness grade symbol for the roughness value of 6.3 micrometers is
(1) N 9 (2) N 10 (3) N 11 (4) N 12

127. The sand used for making cores is
(1) green sand (2) dry sand
(3) loam sand (4) oil sand

128. Steel balls for ball bearings are generally made of
(1) stainless steel (2) nodular cast iron
(3) free carbon steel (4) carbon chrome steel

129. The shock resistance of steel is increased by adding
(1) nickel (2) chromium
(3) cobalt and molybdenum (4) nickel and chromium

130. The force that cancels the effect of the force system acting on the body is known as
(1) resultant (2) equilibrant
(3) neutral force (4) balancing force

131. In the method of joints for the analysis of forces in the members of the truss, the number of equilibrium equations, which are available at each joint are
(1) 2 (2) 3 (3) 4 (4) 5

Set Code : T2
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132. The point in the stress versus strain diagram at which the cross sectional area of the test specimen starts decreasing is called
(1) elastic limit (2) upper yield point
(3) lower yield point (4) ultimate stress point

133. A simply supported beam A of length 1 breadth b and depth d carries a central load W. Another beam of the same dimensions carries a central load equal to 2W. The deflection of beam B will be _____ as that of A
(1) one fourth (2) half (3) double (4) four times

134. The percentage elongations for a ductile material are usually
(1) less than 5% (2) 5 to 10% (3) 10 to 15% (4) more than 15%

135. In a strained material subjected to two normal stresses, the maximum shear stress is equal to
(1) sum of the normal stresses (2) difference of the normal stresses
(3) half the sum of the normal stresses (4) half the difference of the normal stresses

136. The strain energy stored in a body when suddenly loaded is _____ the strain energy stored when same load is applied gradually.
(1) half (2) equal to (3) twice (4) four times

137. In powder metallurgy the range of pressures to which powdered metals in desired proportions are compressed in noulds is
(1) 10 to 50 bar (2) 50 to 300 bar
(3) 310 to 650 bar (4) 690 to 13750 bar

138. The velocity of the belt of mass 'm' and tension 'T', for maximum power is
(1) T/3 (2) Tx3 (3) $\sqrt{T}/3m$ (4) $\sqrt{(3m/T)}$

Set Code : T2
Booklet Code : A

139. The included angle for the V-belt is usually
(1) 10 to 20° (2) 20 to 30°
(3) 30 to 40° (4) 50 to 60°

140. When the belt is stationary, it is subjected to some tension known as initial tension. The value of this tension is equal to the
(1) tension in the tight side of the belt
(2) tension in the slack side of the belt
(3) sum of the tensions on the tight side and slack side of the belt
(4) average tension of the tight and slack sides of the belt

141. The relation between the pitch of the chain (p) and pitch circle diameter of the sprocket (D) is given by
(1) $p = D \sin(90°/T)$ (2) $p = D \sin(120°/T)$
(3) $p = D \sin(180°/T)$ (4) $p = D \sin(360°/T)$

142. In roller chain the roller diameter is approximately _____ of the pitch.
(1) 5/8 (2) 6/8 (3) 7/8 (4) same as that

143. When spring index increases, the value of Wahl's stress factor
(1) increases linearly (2) decreases linearly
(3) remains same (4) increases exponentially

44. When two non intersecting and non-coplanar shafts are connected by gears, the arrangement is known as
(1) spur gearing (2) helical gearing
(3) bevel gearing (4) spiral gearing

145. Pitch point of a cam is
(1) a point on the pitch curve having minimum pressure angle
(2) a point on the pitch curve having maximum pressure angle
(3) any point on the pitch curve
(4) any point on the pitch circle

146. The ratio of hoop stress to longitudinal stress is
(1) 0.5 (2) 1 (3) 2 (4) 3

147. The shaft A is solid of diameter 100 mm and shaft B is hollow with outer diameter 100 mm and inner diameter 50 mm and both of them are made of same material. The torque transmitted by shaft B is _____ as that of shaft A.
(1) 1/8 (2) 1/6 (3) 13/12 (4) 15/16

148. Steady flow energy equation for a compressor is
(1) $w = h_2 - h_1$ (2) $w = h_1 - h_2$ (3) $Q = h_1 - h_2$ (4) $h_1 = h_2$

149. Work done in a flow process is
(1) pv (2) $\int pdv$ (3) $\int vdp$ (4) $-\int vdp$

150. The hyperbolic process is governed by
(1) Boyle's law (2) Charles' law (3) Avogadro's law (4) Gay-Lussac law

151. Reversed Joule cycle is known as
(1) Rankine cycle (2) Carnot cycle
(3) Bell-Coleman cycle (4) Stirling cycle

Set Code : T2
Booklet Code : A

152. For same heat input and compression ratio, the order of efficiency of Otto, Diesel and Dual cycles is
(1) $\eta_{Otto} > \eta_{Diesel} > \eta_{Dual}$ (2) $\eta_{Otto} > \eta_{Dual} > \eta_{Diesel}$
(3) $\eta_{Diesel} > \eta_{Dual} > \eta_{Otto}$ (4) $\eta_{Dual} > \eta_{Otto} > \eta_{Diesel}$

153. The condition for an irreversible cycle is
(1) $\delta(\delta q/T) = 0$ (2) $\delta(\delta q/T) < 0$ (3) $\delta(\delta q/T) > 0$ (4) $\delta(\delta q/T) = \infty$

154. The isentropic process means
(1) reversible process (2) adiabatic process
(3) reversible adiabatic process (4) constant entropy process

155. During throttling process in an expansion valve of a refrigerator
(1) enthalpy remains constant but pressure decreases
(2) pressure remains constant but enthalpy decreases
(3) constant enthalpy process
(4) both pressure and enthalpy remains constant

156. A mixture of gas in a container of 0.05 m^3 is heated by supplying 100 kJ of heat during the process. The change in internal energy of the mixture is
(1) 0 kJ (2) 5 kJ (3) 100 kJ (4) 2000 kJ

157. The effective inhibitor of pre-ignition is
(1) alcohol (2) water (3) lead (4) diesel

158. In the expression of brake power BP = $(2\pi nT/60)$, for a four stroke engine 'n' should be taken as
(1) N (2) N/2 (3) 2N (4) N/4
where, N = speed of the crank shaft in rpm

Set Code : T2
Booklet Code : A

159. Hydrocarbon fuels of Paraffin family are being used in S.I. engines, due to
(1) high cetane number (2) high octane number
(3) high heating value (4) high specific heat

160. The flow ratio in case of Francis turbine varies from
(1) 0.15 to 0.3 (2) 0.4 to 0.5 (3) 0.6 to 0.9 (4) 1 to 1.5

161. The ratio of the normal force of jet of water on a plate inclined at an angle of 60^{o} as compared to that when the plate is normal to jet, is
(1) 1 (2) $\sqrt{3}/2$ (3) 1/2 (4) 0

162. In all reaction turbines, for maximum efficiency
(1) the velocity of flow at outlet must be zero
(2) the velocity of flow at inlet must be zero
(3) the velocity of whirl at entrance must be zero
(4) the velocity of whirl at outlet must be zero

163. Centrifugal pumps dealing with mud have an impeller of the type
(1) open (2) double suction
(3) one-side shrouded (4) two-sides shrouded

164. Specific speed of impulse turbine ranges from
(1) 1000 to 2000 (2) 300 to 1000 (3) 60 to 300 (4) 10 to 50

165. Hydraulic ram is a pump which works on the principle of
(1) centrifugal action (2) reciprocating action
(3) positive displacement action (4) inertia forces of water in the supply line

Set Code : T2
Booklet Code : A

166. Spare Ignition engine works on
(1) Diesel cycle (2) Otto cycle (3) Dual cycle (4) Ericssion cycle

167. While drawing a hydraulic or pneumatic circuit, it must begin with _____ and end with ____
(1) pump, actuator (2) filter, flow control valve
(3) pressure gauge, pressure control valve (4) service units, signaling elements

168. The pressure lines in the wet region of Mollier chart are straight because
(1) pressure remains constant (2) volume remains constant
(3) temperature remains constant (4) enthalpy remains constant

169. A safety valve mainly used with locomotive and marine boilers is
(1) lever safety valve (2) dead weight safety valve
(3) high steam and low water safety valve (4) spring loaded safety valve

170. In order to compare the capacity of boilers, the feed water temperature and working pressure are taken as
(1) 100°C and normal atmospheric pressure
(2) 100°C and 1.1 bar
(3) 50°C and normal atmospheric pressure
(4) 50°C and 1 bar pressure

171. The Mach number of steam flow at exit to a convergent divergent nozzle should be
(1) 0 (2) less than 1 (3) more than 1 (4) equal to 1

172. When the back pressure of a nozzle is below the designed value of pressure at exit of nozzle, the nozzle is said to be
(1) under expanding (2) over expanding
(3) choked (4) super saturated

Set Code : T2
Booklet Code : A

173. The available enthalpy drop in a supersaturated flow of steam through a nozzle as compared to an equilibrium flow
(1) remains same
(2) increases
(3) decreases
(4) unpredictable

174. The Parson's reaction turbine has
(1) only moving blades
(2) only fixed blades
(3) different shapes of fixed and moving blades
(4) identical shape of fixed and moving blades

175. The isentropic enthalpy drop in moving blade is 2/3rd of the isentropic enthalpy drop in fixed blades of a turbine. The degree of reaction will be
(1) 0.4 (2) 0.56 (3) 0.67 (4) 1.67

176. The cooling system used for supersonic air crafts and rockets is
(1) simple air cooling system
(2) boot-strap air cooling system
(3) reduced ambient air cooling system
(4) regenerative air cooling system

177. The capacity of a domestic refrigerator is in the range of
(1) 0.1 to 0.3 T
(2) 0.5 to 1.0 T
(3) 1 to 3 T
(4) 3 to 5 T

178. The capillary tube is not used in large capacity refrigeration systems because
(1) It is made of copper
(2) Capacity control is not possible
(3) required pressure drop cannot be achieved
(4) cost is too high

Set Code : T2
Booklet Code : A

179. In aqua-ammonia and lithium bromide - water absorption refrigeration systems, the refrigerants are respectively
(1) water and water
(2) water and lithium bromide
(3) ammonia and lithium bromide
(4) ammonia and water

180. Queuing theory is associated with
(1) inventory (2) sales (3) waiting time (4) production time

181. The routing function in a production system design is concerned with
(1) manpower utilization
(2) machine utilization
(3) quality assurance of the product
(4) optimizing material flow through the plant

182. The value engineering technique in which experts of the same rank assemble for product development is called
(1) brain storming
(2) Delphi
(3) morphological analysis
(4) direct expert comparison

183. The type of organization preferred for an automobile industry
(1) line organization
(2) functional organization
(3) line and staff organization
(4) line, staff and functional organization

184. The mathematical technique for finding the best use of limited resources of a company in the maximum manner is known as
(1) value analysis
(2) network analysis
(3) queuing theory
(4) linear programming

185. For a small scale industry the fixed cost per month is Rs.5000/-. The variable cost per product is Rs. 20/- and sales price is Rs.30/- per piece. The break even production per month will be
(1) 300 (2) 400 (3) 500 (4) 1000

Set Code : T2
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186. Bin cards are used in
(1) machine loading (2) quality control (3) stores (4) inventory

187. The chart which gives an estimate about the amount of materials handling between various work stations is known as
(1) flow chart (2) process chart (3) travel chart (4) operation chart

188. The type of layout suitable for manufacturing tools and gauges
(1) product layout (2) process layout
(3) combination of product and process layout (4) fixed position layout

189. The forecasting technique used for new products is
(1) Box Jenkins (2) Single exponential smoothing
(3) Delphi type (4) simple regression

190. Six sigma level of quality control means
(1) 2.1 defects per million opportunities (2) 3.4 defects per million opportunities
(3) 4.3 defects per million opportunities (4) 5.7 defects per million opportunities

191. In inventory control theory, the economic order quantity is
(1) average level of inventory (2) optimum lot size
(3) capacity of a warehouse (4) lot size corresponding to break-even analysis

192. In a single dry plate clutch, torsional vibrations are absorbed by
(1) coil springs (2) cushion springs (3) central hub (4) clutch pedal

193. The torque converter uses _____ to transfer torque.
(1) air (2) automatic transmission fluid
(3) gears (4) steel belt

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194. In a four wheel drive, the number of gear boxes are
(1) 1 (2) 2 (3) 3 (4) 4

195. In a hydraulic power steering system, the power steering pump is driven by a
(1) belt driven by camshaft (2) chain driven by crankshaft
(3) belt driven by driveshaft (4) belt driven by crankshaft

196. Which of the following parameter can be adjusted by modifying the tie-rod attachment length?
(1) camber (2) caster (3) toe (4) steering gear ratio

197. The gudgeon pin connects
(1) crankshaft and connecting rod (2) connecting rod and piston
(3) connecting rod and cam shaft (4) piston and crank shaft

198. The function of antilock brake system is that it
(1) reduces the stopping distance
(2) minimizes the brake fade
(3) maintains directional control during braking by preventing the wheels from locking
(4) prevents nose dives during braking and there by postpones locking of the wheels

199. Odometer is an instrument used for measurement of
(1) power (2) fuel consumption
(3) engine rpm (4) distance

200. The problem caused by the wheel imbalance is
(1) hard steering and hard ride
(2) poor acceleration and hard steering
(3) steering wheel vibrations and uneven tyre wear
(4) poor acceleration and reduced fuel efficiency