

## (MEC)

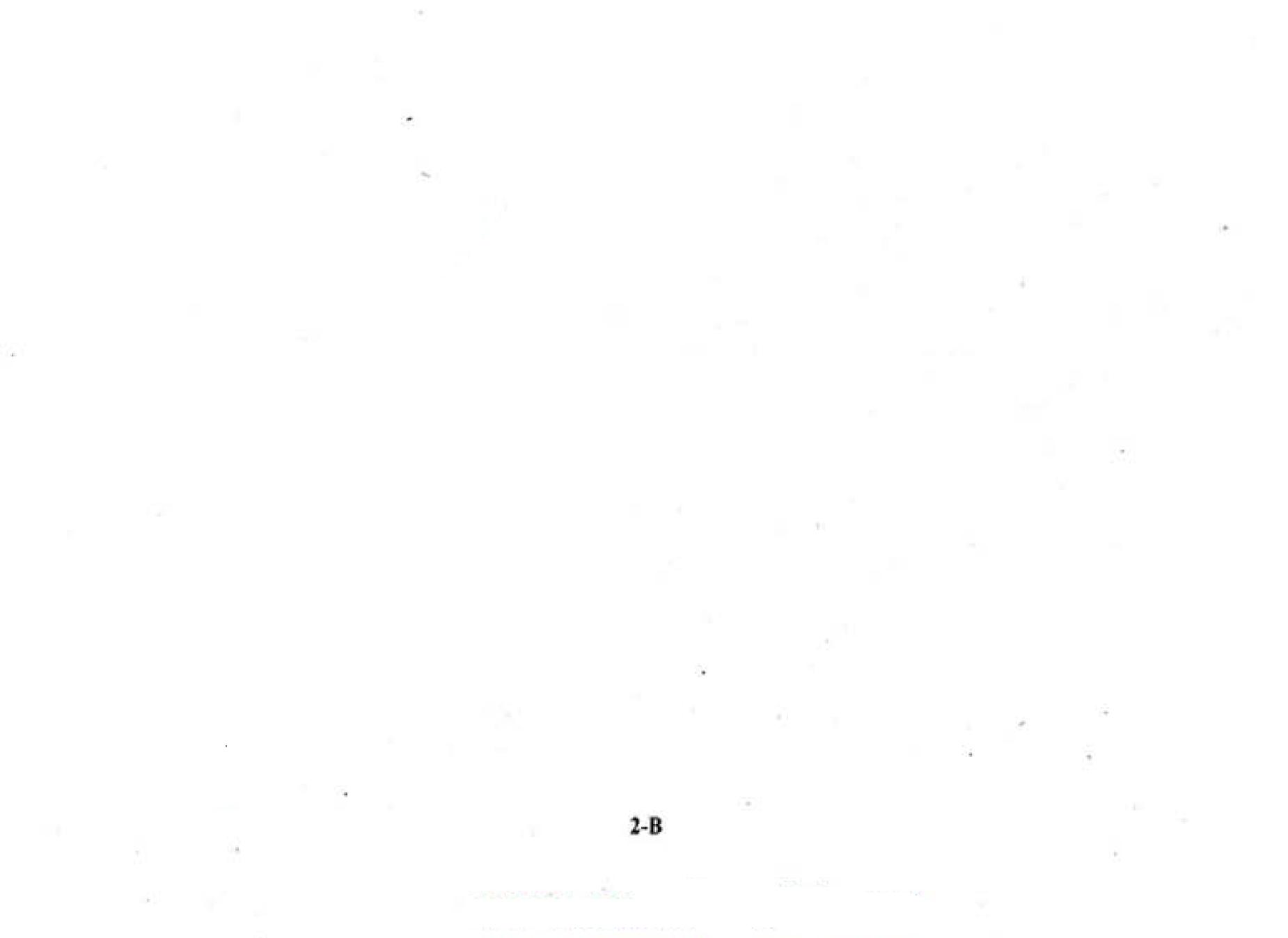
### MECHANICAL ENGINEERING INSTRUCTIONS TO CANDIDATES

- Candidates should write their Hall Ticket Number only in the space provided at the top left hand corner of this page, on 1. 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 BALL POINT PEN (BLUE/BLACK) ONLY ON THE OMR RESPONSE SHEET. DO NOT WRITE HALL TICKET NUMBER ANY WHERE ELSE.
- Immediately on opening this Question Paper Booklet, check. 2.
  - Whether 200 multiple choice questions are printed (50 questions in Mathematics, 25 questions in Physics, (a) 25 questions in Chemistry and 100 questions in Engineering)
  - In case of any discrepancy immediately exchange the Question paper Booklet of same code by bringing (b) the error to the notice of invigilator.
- 3. Use of Calculators. Mathematical Tables and Log books is not permitted.
- Candidate must ensure that he/she has received the Correct Question Booklet, corresponding to 4. his/her branch of Engineering. Candidate should ensure that the booklet Code and the Booklet Serial Number, as it appears on this page is 'Ş. j entered at the appropriate place on the OMR Response Sheet by shading the appropriate circles provided therein using Ball Point Pen (Blue/Black) 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. Candidate shall shade one of the circles 1, 2, 3 or 4 corresponding question on the OMR Response 6. Sheet using Ball Point Pen (Blue/Black) only. Candidate should note that their OMR Response Sheet will be invalidated if the circles against the question are shaded using pencil or if more than one circle. is shaded against any question.
- One mark will be awarded for every correct answer. There are no negative marks. 7.
- 8. The OMR Response Sheet will not be valued if the candidate :
  - Writes the Hall Ticket Number in any part of the OMR Response Sheet except in the space provided for (a) the purpose.
  - Writes any irrelevant matter including religious symbols, words, prayers or any communication whatsoever (b) in any part of the OMR Response Sheet.
  - Adopts any other malpractice. (c)
- 9. Rough work should be done only in the space provided in the Question Paper Booklet.
- No loose sheets or papers will be allowed in the examination hall. 10.
- Timings of fest: 10.00 A.M. to 1.00 P.M. П.
- Candidate should ensure that he / she enters his / her name and appends signature on the Question paper booklet, 12. 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.
- Before leaving the examination hall candidate should return both the OMR Response Sheet and the leaflet 13. 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.



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### SPACE FOR ROUGH WORK



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Note: (1) Answer all guestions.

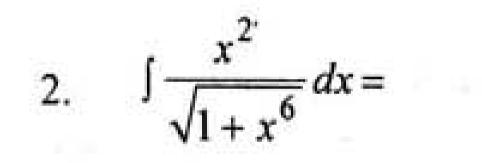
- Each question carries I mark. There are no negative marks. (2)
- Answer to the questions must be entered only on OMR Response Sheet provided separately by (3)completely shading with Ball Point Pen (Blue/Black), only one of the circles 1.2.3 or 4 provided against each question, and which is most appropriate to the question.
- The OMR Response Sheet will be invalidated if the circle is shaded using pencil or if more than (4)one circle is shaded against each question.

### MATHEMATICS

$$1. \quad \int \left(\frac{x+2}{x+1}\right) dx =$$

- (1) $x \log(x+1) + c$
- $x + \log(x+1) + c$ (3)

 $x \log (x+1) + 2 \log (x+1) + c$ (2)  $\frac{1}{2}\log(x+1)+c$ (4)



4.

(1) 
$$\frac{1}{2}\sin^{-1}(x^3) + c$$
  
(3)  $\frac{1}{2}\cos h^{-1}(x^3) + c$   
3.  $\int 8x^3 e^{2x} dx =$   
(1)  $(4x^3 - 6x^2 + 6x - 3) e^{2x} + c$   
(3)  $\left(\frac{4x^2}{3} - \frac{2}{3}x + \frac{1}{3}\right)e^{2x} + c$   
4.  $\lim_{n \to \infty} \left[\frac{1}{n} + \frac{1}{n+1} + \frac{1}{n+2} + \dots + \frac{1}{3n}\right] =$ 

(2)  $2\cos^{-1}(x^3) + c$ 

(4) 
$$\frac{1}{3}\sin h^{-1}(x^3) + c$$

(2) 
$$4x^3 + 6x^2 + 6x + 3e^{2x} + c$$
  
(4)  $\left(\frac{4x^2}{3} + \frac{2}{3}x - \frac{1}{3}\right)e^{2x} + c$ 

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





5. 
$$\int_{0}^{\frac{\pi}{2}} \frac{\sqrt{\sin x}}{\sqrt{\cos x} + \sqrt{\sin x}} dx =$$
(1)  $\frac{\pi}{2}$  (2)  $\frac{\pi}{4}$  (3) 0 (4) 2

6. The area of the region in the first quadrant enclosed by x-axis, y-axis, y = 3x-2 and y = 4 is

(1) 16 (2) 8 (3) 
$$\frac{16}{3}$$
 (4)  $\frac{8}{3}$ 

7. The root mean square (RMS) value of log x over the range x = 1 to x = e is

(1)  $\frac{\sqrt{(e+1)}}{\sqrt{(e-2)}}$  (2)  $\frac{\sqrt{(e-2)}}{\sqrt{(e-1)}}$  (3)  $\frac{\sqrt{(e+2)}}{\sqrt{(e+1)}}$  (4)  $\frac{\sqrt{(e+2)}}{\sqrt{(e-1)}}$ 

$$\sqrt{(e-2)}$$
  $\sqrt{(e-1)}$   $\sqrt{(e-1)}$ 

8. The differential equation formed by eliminating the arbitrary constants a and b in the relation  $y = a \cos(nx+b)$  is

(1) 
$$\frac{d^2 y}{dx^2} + n^2 y = 0$$

$$(3) \quad \frac{dy}{dx} + ny = 0$$

(2) 
$$\frac{d^{3}y}{dx^{3}} - x^{3}y = 0$$
  
(4) 
$$\frac{d^{2}y}{x^{2}} - y = 0$$

9. The solution of 
$$\frac{dy}{dx} = e^{x-y}$$
  
(1)  $e^{x} - e^{-y} + c = 0$   
(3)  $e^{x} + e^{-y} + c = 0$   
(4)  $e^{x} - e^{y} + e^{c} = 0$ 

10. The solution of the differential equation 
$$\tan x \frac{dy}{dx} + y = \sec x$$
 is  
(1)  $y \sin x - x = c$ 
(2)  $y \cot x + x = c$ 
(3)  $y = \tan x + c$ 
(4)  $y \cdot \csc x = x + c$ 



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- 11. The solution of the linear third order equation  $\frac{d^3y}{dx^3} 7\frac{d^2y}{dx^2} + 16\frac{dy}{dx} 12y = 0$  is (1)  $y = c_1 e^{3x} + c_2 e^x + c_3 e^{4x}$ (2)  $y = c_1 e^{3x} + c_2 x e^x + c_3 e^{4x}$ (3)  $y = c_1 e^{2x} + c_2 x e^{3x} + c_3 e^{4x}$ (4)  $y = c_1 e^{3x} + (c_2 + c_3 x) e^{2x}$
- 12. If y<sub>1</sub> = e<sup>x</sup> and y<sub>2</sub> = e<sup>-x</sup> are two solutions of the homogeneous differential equation; then
  (1) y<sub>3</sub> = e<sup>2x</sup> and y<sub>4</sub> = e<sup>-2x</sup> are also solutions of the equation
  (2) y<sub>3</sub> = xe<sup>x</sup> and y<sub>4</sub> = xe<sup>-x</sup> are also solutions of the equation
  (3) y<sub>3</sub> = cosh x and y<sub>4</sub> = sinh x are also solutions of the equation
  (4) y<sub>3</sub> = cos x and y<sub>4</sub> = sin x are also solutions of the equation
- 13. The particular integral (P.I) of the equation  $(D^2+D-6)y = 5e^{2x}+6$  is
  - (1)  $xe^{2x} 1$ (3)  $5xe^{2x} + 1$ (4)  $e^{2x} - 1$
- 14. The particular integral of  $(D^2+16) y = 8 \cos 4x$  is
  - (1)  $\cos 4x$  (2)  $x \sin 4x$

(3) 
$$-\frac{1}{4}\sin 4x$$
 (4)  $-\frac{1}{4}\cos 4x$ 

5. If 
$$A = \begin{bmatrix} 2 & 4 & 3 \\ 1 & 0 & 2 \\ -3 & 5 & 1 \end{bmatrix}$$
 then,  
(1)  $A = A^T$   
(3)  $A$  is a singular matrix

(2) A is a diagonal matrix(4) A is a nonsingular matrix





16. If 
$$A = \begin{bmatrix} 2 & 5 & 3 \\ 3 & 1 & 2 \\ 1 & 2 & 1 \end{bmatrix}$$
 then

(1) The minors of first row elements are respectively -3, -1, 5

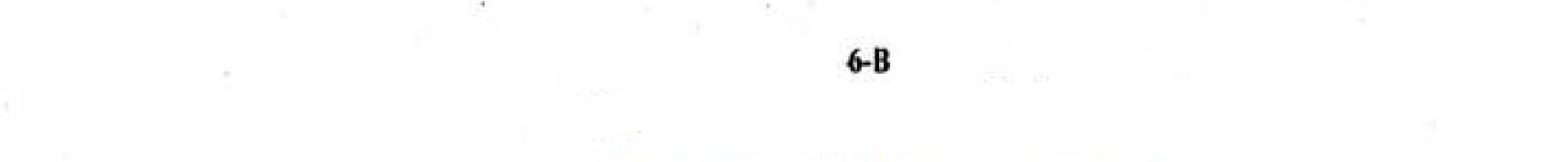
- (2) The cofactors of second row elements respectively are 1, -1, 1
- (3) The cofactors of first row elements respectively are -3, -1, -5
- (4) The minors of second row elements respectively are 7, 5, -13
- 17. If A, B, C are non singular matrices of order 3 then
  - (1)  $A(BC) \neq (AB)C$ (3)  $(ABC)^{-1} = C^{-1}B^{-1}A^{-1}$ (4)  $(ABC)^{-1} = 1/(ABC)$

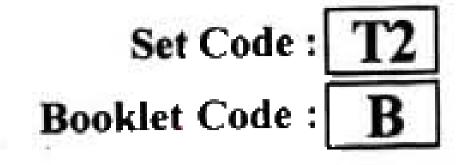
18. If 
$$\begin{bmatrix} 3 & 2 \\ 2 & -3 \end{bmatrix} \begin{bmatrix} x \\ y \end{bmatrix} = \begin{bmatrix} 4 \\ 7 \end{bmatrix}$$
, then  
(1)  $x = -1, y = 4$   
(3)  $x = 4, y = -1$   
(2)  $x = 2, y = -1$   
(4)  $x = -1, y = 2$ 

19. If w is the cube root of unity then 
$$\begin{bmatrix} 1 & w & w^2 \\ w & w^2 & 1 \\ w^2 & 1 & w \end{bmatrix} = (1) \ 0 \qquad (2) \ 1 \qquad (3) \ -1 \qquad (4) \ 2$$

20. If 
$$\frac{x^2 + 13x + 15}{(2x+3)(x+3)^2} = \frac{A}{2x+3} + \frac{B}{x+3} + \frac{C}{(x+3)^2}$$
 then C =  
(1) 10 (2) 5 (3) 3 (4) 1  
21. If  $\frac{2x+1}{(x^2+1)(x-1)} = \frac{Ax+B}{x^2+1} + \frac{C}{x-1}$  then A =

21. If 
$$\frac{2x+1}{(x^2+1)(x-1)} = \frac{Ax+B}{x^2+1} + \frac{C}{x-1}$$
 then  $A =$   
(1) -1
(2)  $\frac{2}{3}$ 
(3)  $-\frac{3}{2}$ 
(4)  $-\frac{2}{3}$ 



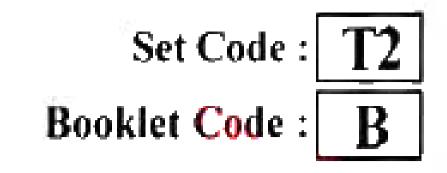


Which of the following statement is TRUE 22. The period of sin x is  $\pi$  and the period of cosec x is  $2\pi$ (A) The period of  $\cos x$  is  $2\pi$  and the period of  $\sec x$  is  $2\pi$ **(B)** The period of tan x is  $2\pi$  and the period of cot x is  $\pi$ (C) The period of cosec x is  $\pi$  and the period of sec x is  $3\pi$ (D) D (4) (3) C B (2)A (1)The range of  $3\cos\theta - 4\sin\theta$  is 23. [-4,0](3) [-5,5](4) (2) [0,4](1) [-1,1]If  $A+B=45^{\circ}$ , then  $(1+\tan A)(1+\tan B) =$ 24. 2 (4) (3) (2)(1)0

25. 
$$\left(\frac{\sin 2A}{1-\cos 2A}\right)\left(\frac{1-\cos A}{\cos A}\right) =$$

(4) cosec  $\frac{A}{2}$ (3) sec  $\frac{A}{2}$ (2)  $\cos \frac{A}{2}$ (1)  $\tan \frac{A}{2}$ sin 70° – cos 40° 26. The value of  $\frac{1}{2}$  $\cos 50^\circ - \sin 20^\circ$ (4) 0 (3)  $\sqrt{3}$ (2)  $\sqrt{2}$ (1) 1 27.  $4 \sin \frac{11\theta}{2} \cos \frac{11}{2} \theta \cos 5\theta$  expressed as sum or difference is  $\sin 16 \theta + \sin 6 \theta$  $\sin 15 \theta - \sin 6 \theta$ (2)(1) $\sin 11 \theta - \sin 8 \theta$ (4)  $\sin 11 \theta + \sin 8 \theta$ (3)If  $2\cos^2\theta + 11\sin\theta = 7$ , the principal value of  $\theta$  is 28. (4)  $22\frac{1}{2}$ (3) 30° (2) 45° (1) 60°

5



29. Which one of the following equation is FALSE (1)  $\cos^{-1}(-x) = \pi - \cos^{-1} x$  (2)  $\sin^{-1}(-x) = \pi - \sin^{-1} x$ 

(3) If 
$$-1 \le x \le 1$$
, then  $\cos^{-1}x + \sin^{-1}x = \frac{\pi}{2}$  (4)  $\sin^{-1}x \ne \frac{1}{\sin x}$ 

- 30. In any triangle ABC,  $\Sigma(b+c) \cos A =$ (1) a+b+c (2) 2(a+b+c) (3) 3(a+b+c) (4) 0
- 31. With the usual notation, in a triangle ABC

$$s\left[\frac{r_{1}-r}{a}+\frac{r_{2}-r}{b}+\frac{r_{3}-r}{c}\right] =$$
(1) 2 (r\_{1}+r\_{2}+r\_{3}) (2) 3 (r\_{1}+r\_{2}+r\_{3}) (3) r\_{1}+r\_{2}+r\_{3} (4) 0

32: The modulus amplitude form of  $-\sqrt{3} + i$  is

(1) 
$$2 \operatorname{cis} \frac{5\pi}{6}$$
 (2)  $2 \operatorname{cis} \frac{3\pi}{6}$  (3)  $2 \operatorname{cis} \frac{\pi}{3}$  (4)  $2 \operatorname{cis} \frac{\pi}{6}$   
33. If  $x = \cos\theta + i \sin\theta$ , then the value of  $x^6 + \left(\frac{1}{x^6}\right)$   
(1) 0 (2)  $2 i \sin 6\theta$  (3)  $2 \cos 6\theta$  (4)  $2(\cos 6\theta + \sin 6\theta)$   
34. The most general second degree equation  $ax^2 + 2hxy + by^2 + 2gx + 2fy + c = 0$  represents a circle if  
(1)  $a + b = 0, h = 0$  (2)  $a - b = 0, h = 0$   
(3)  $a - b = 0, h \neq 0$  (4)  $a + b \neq 0, h \neq 0$   
35. The equation of the circle whose radius is  $\sqrt{(a^2 - b^2)}$  and whose center is  $(-a, -b)$  is

- (1)  $x^2+y^2+2ax+2by+2a^2 = 0$ (2)  $x^2+y^2-2ax+2(a^2+b^2) = 0$ (3)  $x^2+y^2+2ax+2by+2(a^2-b^2) = 0$ (4)  $x^2+y^2+2ax+2bx+2b^2 = 0$
- 36. The coordinates of the parabola  $y^2 = 18x$  such that the ordinate equals to three times of the abscissa is
  - (1) (3,9) (2) (2,6) (3) (1,3) (4) (162,54)



### Set Code : Booklet Code : B

- With respect to the ellipse  $5x^2+7y^2 = 11$ , the point (4, -3)37.
  - (1)Is a focus
  - (3) lies outside the ellipse
- (2) lies with in the ellipse (4) lies on the ellipse
- For the Hyperbola  $4x^2 9y^2 = 36$ , the coordinates of the foci are 38.

(1)  $(\pm\sqrt{13},0)$  (2)  $(\pm\sqrt{31},0)$  (3)  $(\pm6.0)$  (4)  $(0,\pm6)$ 

- Which of the following statements are FALSE 39.
  - The equation of the tangent at the point (x', y') of the circle  $x^2 + y^2 = a^2$  is  $xx' + yy' = a^2$ (A)
  - The eccentricity of a parabola is unity **(B)**
  - The eccentricity of an ellipse is greater than unity (C)
  - The eccentricity of a hyperbola is less than unity (D)
  - (1)A,B (2) A,D (3) B,C C,D (4)

40. 
$$\lim_{x \to \infty} \frac{3^{x+1}+4}{3^{x+2}+4} =$$
(1) 1
(2) 0
(3)  $\frac{3}{4}$ 
(4)  $\frac{1}{3}$ 
  
41. Derivative of  $\cos^{-1}\left(\frac{1-x^2}{1+x^2}\right)$  with reference to x is
(1)  $\frac{2}{1+x^2}$ 
(2)  $\frac{1}{1-x^2}$ 
(3)  $2x$ 
(4)  $\sqrt{(1+x^2)}$ 
  
42. If  $y = x^{3x}$ .  $(x > 0)$  then  $\frac{dy}{dx} =$ 
(1)  $3.x^{3x-1}$ 
(2)  $3x^{2x}$ 
(3)  $3y(1+\log x)$ 
(4)  $\frac{3y}{\log x}$ 



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43. If 
$$x^{\frac{2}{3}} + y^{\frac{2}{3}} = a^{\frac{2}{3}}$$
 then  $\frac{dy}{dx} =$   
(1)  $\left(\frac{x}{y}\right)^{\frac{1}{3}}$  (2)  $-\left(\frac{y}{x}\right)^{\frac{1}{3}}$  (3)  $-\left(\frac{x}{y}\right)^{\frac{1}{3}}$  (4)  $\left(\frac{y}{x}\right)^{\frac{1}{3}}$ 

44. The derivative of log sec x with respect to  $\tan x$  is (1)  $\sec x \cdot \tan x$  (2)  $\cos x \cdot \cot x$  (3)  $\cos x \cdot \sin x$  (4)  $\sec x \cdot \cot x$ 

45. The coordinates of the point P(x, y) on the curve of  $y = x^2 - 4x + 5$  such that the tangent at P is parallel to y = 2x + 4 are (1) (3, 2) (2) (1, 2) (3) (2, 1) (4) (5, 4)

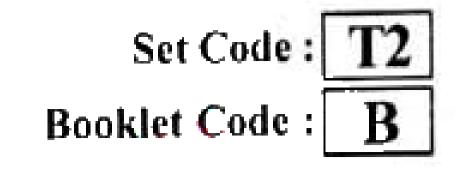
46. The function  $f(x) = x \log^2 x$  has

- (1) Maximum value occurs when  $x = \frac{1}{e}$  (2) Maximum value occurs when x = e
- (3) Maximum value occurs when  $x = e^{-2}$  (4) Maximum value occurs when  $x = e^{2}$
- 47. In a cube the percentage increase in side is 2 units. The percentage increases in the volume of the cube is
   (1) 2
  - (1) 3 (2) 6 (3) 8 (4) 16
- 48. The curves  $x = y^2$  and xy = m cut at right angle if (1) m = 0 (2)  $m^2 = 8$  (3)  $8m^2 = 1$  (4) m = -1
- 49. If  $u = e^{ax} \sin by$ , then  $\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2} =$ (1)  $(a^2 - b^2) u$  (2)  $a^2 + b^2$  (3)  $(a^2 + b^2) u$  (4) (a + b) u

50. 
$$\int \frac{\cos\sqrt{x}}{\sqrt{x}} dx =$$

(1)  $\sqrt{x} \sin \sqrt{x} + c$  (2)  $2 \sin \sqrt{x} + c$  (3)  $\sqrt{\cos x} + c$  (4)  $\frac{\sin \sqrt{x}}{\sqrt{x}} + c$ 



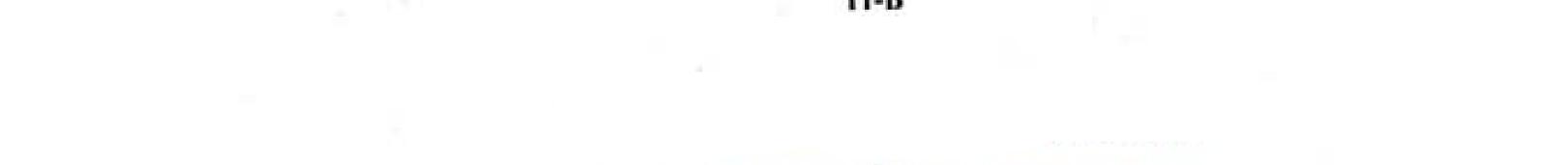


### PHYSICS

- 51. In thermodynamics, dQ = 0 and dU = -dW is true for
  - (1) Isothermal process (2) Adiabatic process
  - (3) Isochoric process (4) Isobaric process
- 52. A sample of an ideal gas has volume V, pressure P and temperature T. The mass of each molecule of the gas is m. The density of the gas is \_\_\_\_\_\_\_
   (1) P/kVT (2) mkT (3) mP/kT (4) P/kT
- 53. A gas does 4.5 J of external work during adiabatic expansion. Its temperature falls by 2 K. Its internal energy will be \_\_\_\_\_\_
  - (1) increase by 4.5 J (2) increase by 9.0 J
  - (3) decrease by 4.5 J (4) decrease by 2.25 J
- 54. One mole of an ideal gas ( $\gamma = 5/3$ ) is mixed with one mole of diatomic gas ( $\gamma = 7/5$ ). The value of  $\gamma$  of the mixture

(1) 3/2 (2) 4/3 (3) 23/15 (4) 35/23

- 55. In a given process on an ideal gas, dW = 0 and dQ < 0. Then for the gas \_
  - (1) the temperature will decrease (2) the volume will increase
  - (3) the pressure will remain constant
- (4) the temperature will increase
- 57. The propagation of light through an optical fiber goes by the principle
  - (1) Refraction
     (2) Total internal reflection
     (3) Interference
     (4) Diffraction
- 58. The dimensions of angular momentum are (1)  $MLT^{-1}$  (2)  $ML^{-1}T$  (3)  $ML^{0}T^{-2}$  (4)  $ML^{2}T^{-1}$
- 59. The SI unit of universal gas constant R is
  - (1) Newton  $K^{-1} \mod 1$  (2) Joule  $K^{-1} \mod 1$
  - (3) Watt  $K^{-1}$  mol<sup>-1</sup> (4) erg  $K^{-1}$  mol<sup>-1</sup>



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- The magnitude of the resultant of (A+B) and (A-B) is \_\_\_\_\_ 60.
  - $(2) \quad \sqrt{\left(A^2+B^2\right)}$ (1) 2A

(3) 
$$2B$$
 (4)  $\sqrt{(A^2 - B^2)}$ 

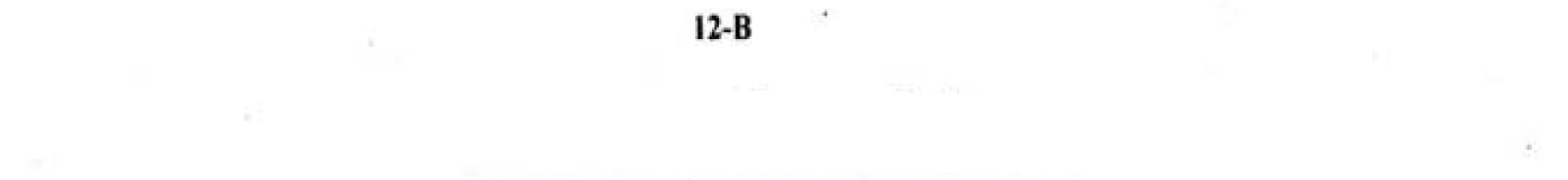
- 61. Given A.B = 0 and  $A \times C = 0$ , the angle between B and C is \_\_\_\_\_ (4) 45° (3) 180° · (2) 90° (1) 135°
- 62. A projectile has a maximum range of 200m. The maximum height attained by it is
  - 100 m (2)(1) 75 m
  - 50 m (4)(3) 25 m
- 63. A block of mass M is lying on a horizontal frictionless surface. One end of a rope mass m is fixed to the block and a force F is applied at the free end parallel to the surface. The force acting on the block will be
  - FM/(M-m)(1)
  - FM/(M+m)(3)

Fm/(M+m)(2)(4) F

- A block of weight 200 N is pulled along a rough horizontal surface at a constant speed by a force 64. of 100 N acting at an angle of 30°. The coefficient of friction between the block and the surface 1S 0.65 (3) 0.45 (1) 0.58 (2) 0.75 (4)
- 65. A boy wants to climb down a rope. The rope can withstand a maximum tension equal to two-thirds the weight of the boy. If g is the acceleration due to gravity, the minimum acceleration with which the boy should climb down the rope is (3) 3g/2 (**2**) 2g/3 (4) g (1) g/3

N bullets each of mass m kg are fired with a velocity v m/s, at the rate of n bullets per second, 66. upon a wall. The reaction offered by the wall to the bullets is given by \_\_\_\_\_ (2) nNmvnNv/m (1)

- (4) nNm/vNmv/n (3)
- 67. A machine gun fires a bullet of mass 40 g with a velocity of 1200 m/s. The man holding it can exert a maximum force of 144 N on the gun. The number of bullets he can fire per second is (4) (2)(1)4





68. A horizontal force F pulls a 20 kg box at a constant speed along a horizontal floor. If the coefficient of friction between the box and the floor is 0.25. The work done by the force F in moving the box through a distance of 2 m

(1)	49 J	(2)	147 J
(3)	196 J	(4)	98 J

A uniform rod of mass m and length l is made to stand vertically on one end. The potential energy 69. of the rod in this position is

(1) mgl/4(2) mgl/2(3) mgl (4) mgl/3

- If momentum is increased by 20%, then kinetic energy increases by \_\_\_\_\_ 70. (2) 77% (3) 55% (4) 66% (1) 44%
- A particle is executing linear SHM of amplitude A. When the displacement is half the amplitude 71. the fraction of kinetic energy is

(3)1/23/4 1/5(1)

- 72. For a particle executing S.H.M starting from equilibrium position the phase is  $\pi/2$  when it has
  - maximum displacement (1)(2)maximum energy
  - half the displacement (3)

maximum velocity (4)

- A particle executes SHM between x = -A and x = +A. The time taken for it to go from 0 to A/2 is 73.  $T_1$  and to go from A/2 to A is  $T_2$ . Then
  - (1)  $T_1 = 2T_2$ (2)  $T_1 = T_2$ (4)  $T_1 > T_2$ (3)  $T_1 < T_2$
- 74. Two sounds of wavelengths 5 m and 6 m, travelling in a medium produce 10 beats per second. The speed of sound in the medium
  - (2) 320 m/s (1) 300 m/s(3) 350 m/s · (4) 1200 m/s
- 75. An observer moves towards a stationary source of sound with a velocity one tenth the velocity of sound. The apparent increase in frequency \_ (3) 5% (1) 3%(2) 0.1% 10% (4)



### Set Code : Booklet Code : B

### CHEMISTRY

- Glass is corroded by 76.
  - Fluorine (dry or wet) (1)
  - Phosphoric acid (3)

- Sulphuric acid (concentrated) (2)
- Carbonic acid (4)
- The most resistant material to alkaline corrosion is 77.
  - Nickel (2)Cast iron (1)Brass (4)Aluminium (3)
- The monomer of polyvinyl chloride is 78.
  - Chloro ethene (1)
  - Ethyl chloride (3)
- Polythene is 79.

- Ethylene dichloride (2)
- Chloroform (4)
- - An addition polymerization product (1)
  - Thermosetting (3)
- Teflon is 80.
  - Phenol formaldehyde (1)
  - Poly tetrafluoroethylene (3)
- Water gas constitutes mainly of 81.
  - CO and H, (1)
  - CO, and H, (3)
- The lightest particle is 82.
  - Positron (1)
  - Proton (3)

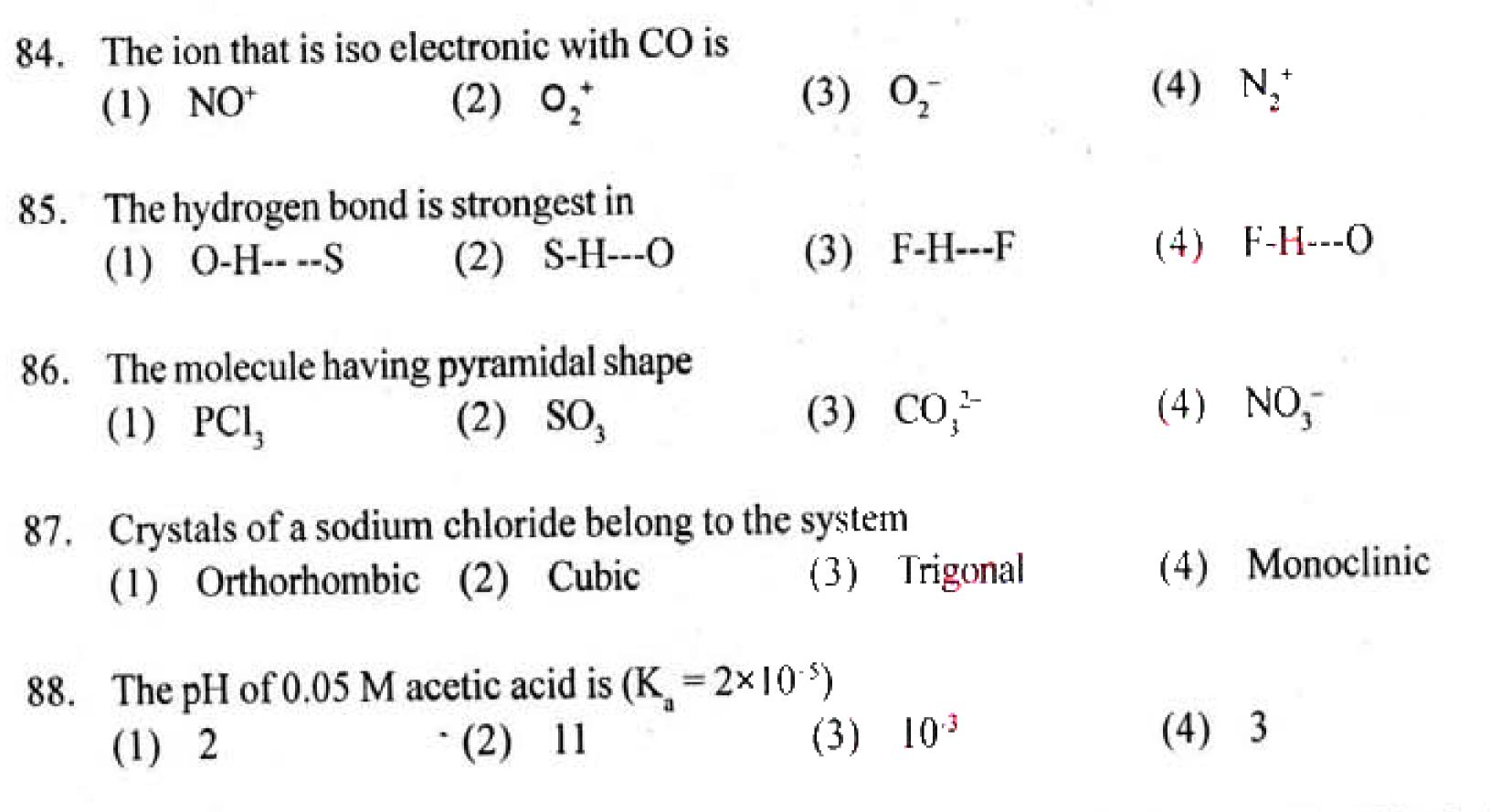
- A condensation polymerization product (2)
- Polymer of amylopectin (4)
- An inorganic polymer (2)A monomer (4)

CO and N, (2)CH<sub>4</sub> and H<sub>2</sub> (4)

- Neutron (2)α-particle (4)
- 83. If an electron has spin quantum number of +1/2 and magnetic quantum number of -1, it cannot be present in s orbital p orbital (4)(3) forbital (1) d orbital (2)

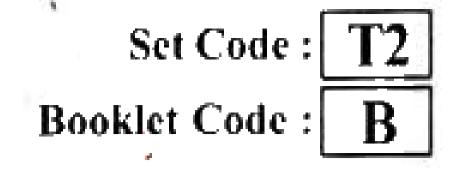


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- 89. The volume in ml. of 0.1 M solution of NaOH required to completely neutralize 100 ml of 0.3 M solution of H<sub>2</sub>PO<sub>2</sub> is
  - 30 (4)300 (3) (1) 60 600 (2)
- The Pka values of four carboxylic acids are 4.76, 4.19, 0.23 and 3.41 respectively. The strongest 90. carboxylic acid among them is the one having Phavalue of 4.76 (4) (3) 0.23 (2) 3.41 (1) 4.19
- If pH value of a solution is 8, then its pOH value will be 91. 10 (4) (3) 6 (2) 1 (1) 7
- 92. The standard reduction potential for Li<sup>+</sup>/Li, Zn<sup>+2</sup>/Zn; H<sup>+</sup>/H, and Ag<sup>+</sup>/Ag are -3.05, -0.762, 0.000 and +0.80 V respectively. Which is the strongest reducing agent? (4) Li (2) H Zn (3) (1) Ag
- The standard reduction potential for the following half-cell reactions are 93.  $Zn = Zn^{+2} + 2e^{-}E^{\circ} = -0.76V$  $Fc = Fe^{+2} + 2c^{-}E^{\circ} = -0.44V$ The E.M.F. for the cell reaction  $Fe^{+2}+Zn \rightarrow Zn^{+2} + Fe$  will be -1.20 V (3) +1.20 V (2) +0.32 V (4)- 0.32 V (1)





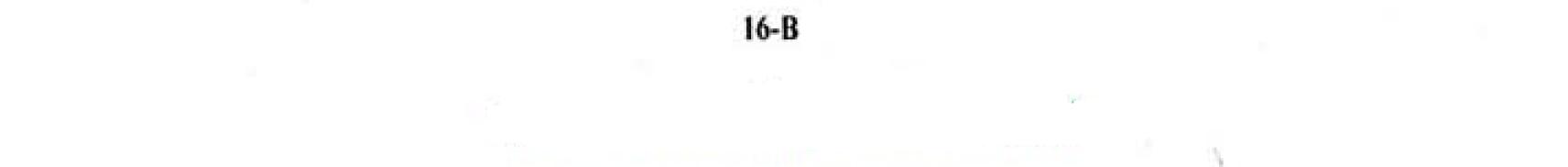
- 94. In salt bridge, KCl is used because
  - KCI is present in calomel electrode.
  - (2) K<sup>+</sup> and Cl<sup>-</sup> ions are not iso electronic
  - (3) K\* and CI<sup>-</sup> ions have the same transport number
  - (4) KCl is an electrolyte
- 95. The metal that cannot be obtained by electrolysis of aqueous solution of its salt is  $(1) = A\alpha$ 
  - (1) Ag (2) Au (3) Cu (4) Al
- 96. BOD of raw municipal sewage may be about
   (1) 2-5 mg/lit
   (2) 5-10 mg/lit
   (3) 150-300 mg/lit
   (4) 2000-3000 mg/lit
- 97. The pH value of potable water should be between (1) 1 to 1.5 (2) 6.5 to 8 (2) 12 to 14
  - (3) 13 to 14

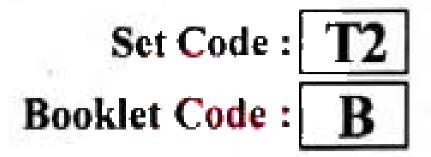
- (4) 4 to 5
- 98. Deaeration of high pressure boiler feed water is done to reduce
  - (1) Foaming from boilers
  - (3) Its silica content

- (2) Its dissolved oxygen content
- (4) Caustic embrittlement
- Presence of non-biodegradable substances like alkyl benzene sulphonate from detergents in polluted water stream causes
  - (1) Fire hazards
- (3) Persistent foam

- (2) Explosion hazards
- (4) Depletion of dissolved oxygen
- 100. Presence of soluble organics in polluted water causes
  - (1) Undesirable plants growth
  - (3) Fire hazards

- (2) Depletion of oxygen
- (4) Explosion hazards





### MECHANICAL ENGINEERING

101. The hydraulic efficiency of an impulse turbine is maximum when velocity of wheel is of the jet velocity

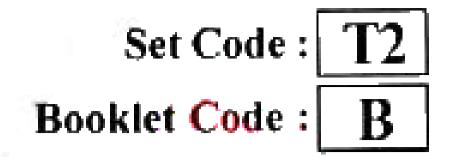
- 1/2(1)1/4 (2)3/4 double (4)(3)
- 102. The speed ratio in case of Francis turbine varies from
  - 0.15 to 0.3 0.4 to 0.5 (2)(1)
  - (4)1 to 1.5 0.6 to 0.9 (3)
- 103. In a centrifugal pump, the regulating valve is provided on the
  - (1) Casing (2) Delivery pipe

    - Suction pipe (3)

- Impeller (4)
- 104. In a reciprocating pump, air vessels are used to
  - Reduce suction head Smoothen the flow (2)(1)
  - Increase delivery head (3)

- Reduce acceleration head (4)
- 105. Which of the following hydraulic unit is used for transmitting increased or decreased torque to the driven shaft?
  - Hydraulic ram (1)
  - Hydraulic torque converter (3)
- Hydraulic intensifier (2)
- Hydraulic accumulator (4)
- 106. The best suited boiler for meeting the fluctuating demand of steam is
  - Lancashire boiler Cornish boiler (2)(1)
  - Babcock and Wilcox boiler (3)
- Locomotive boiler (4)





- 107. 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 pressure
  - (3) 50°C and normal atmospheric pressure
  - (4) 50°C and 1.1 bar pressure
- 108. The power of a boiler may be defined as
  - (1) The evaporation of 15.653 kg of water per hour from and at 100°C
  - (2) The ratio of heat actually used in producing the steam to the heat liberated in the furnace
  - (3) The amount of water evaporated or steam produced in kg per kg of fuel burnt
  - (4) The amount of water evaporated from and at 100°C to produce dry and saturated steam

109. The shape of the nozzle used for obtaining supersonic velocities is

- (1) Short length convergent nozzle (2) Long length convergent nozzle
- (3) Divergnet nozzle

(4) Convergent - Divergent nozzle

110. Generally the limit of super saturation is upto a dryness fraction of about

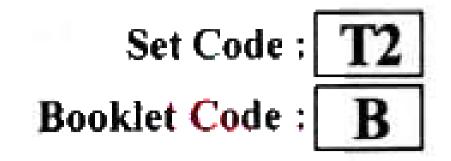
- (1) 98% 100%
  (2) 96% 98%
  (3) 94% 96%
  (4) 92% 94%
- A single stage impulse turbine with diameter of 2m runs at 3600 rpm. If the blade speed ratio is 0.4, then the inlet velocity of the steam will be

(1)	120.9 m/s	(2)	150.8 m/s
(3)	942.6 m/s	(4)	1440.4 m/s

112. The efficiency of reaction turbine is maximum when

(1)  $V_b = 0.5 V \cos \alpha$ (3)  $V_b = 0.5 V^2 \cos \alpha$ (4)  $V_b = V^2 \cos \alpha$ Where,  $V_b$  = blade speed, V = absolute velocity of steam,  $\alpha$  = nozzle angle





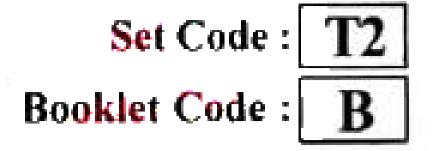
- 113. A steam turbine, in which a part of the steam after partial expansion is used for process heating and the remaining steam is further expanded for power generation is known as
  - Back pressure turbine Impulse turbine (2)(1)
  - Pass out turbine Low pressure turbine (4)(3)
- 114. The capacity of domestic refrigerator is in the range of
  - 1 to 3 TR 0.1 to 0.3 TR (2)(1)5 to 7 TR 3 to 5 TR (4)(3)
- 115. A condenser of refrigerator rejects heat at the rate of 150 kW, while its compressor consumes a power of 50 kW. The coefficient of performance of the system will be (4) 3 (3) 2 1/31/2(1)(2)
- 116. The material of pipe lines for a system using Freon as a refrigerant should be
- - Steel (2)Copper (1)
  - Brass (3)

Aluminium (4)

- 117. In a vapour compression refrigeration system, a throttle valve is used in place of an expander because
  - Reduces mass of the system (1)
  - Improves COP as the condenser is small (2)
  - Positive work in isentropic expansion of liquid is very small (3)
  - Leads to significant reduction (4)
- 118. In break-even chart the expenditure on publicity to promote sales is shown below the
  - Variable cost line Fixed cost line (2)(1)Sales revenue line Total cost line (4)(3)
- 119. Service time in queuing theory is usually assumed to follow
  - **Poisons distribution** (1)
  - Erlang distribution (3)

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- Normal distribution (2)
- Exponential law (4)



- 120. PERT requires
  - Single time estimate (1)
  - Triple time estimate (3)

- Double time estimate (2)
- (4)Quatraple time estimate
- 121. The type of organization preferred for a steel industry
  - Line organization Functional organization (2)(1)
  - Line and staff organization (3)
- Line, staff and functional organization (4)

122. If A is the total items consumed per year, P is the procurement cost per order and C is the annual inventory carrying cost per item, then the most economic ordering quantity is given by

- (AP/C) $(AP/C)^2$ (2)(1)
- (3) $\sqrt{2}(AP/C)$ (2AP/C)(4)
- 123. The type of layout suitable for manufacturing tools and gauges
  - Product layout (1)
  - Process layout (2)
  - (3)Combination of product and process layout
  - (4)Fixed position layout
- 124. The mathematical technique for finding the best use of limited resources of a company in the maximum manner is
  - Queuing theory Value analysis (1)(2)
  - (3)Network analysis Linear programming (4)
- 125. ISO 9000 is a common quality language among the suppliers and the
  - Manufactures (1)(2)Customer
  - (3)Consumer (4)Manager
- 126. Six sigma level of quality control means
  - 2.1 defects per million opportunites (1)
  - (3)4.3 defects per million opportunites
- 3.4 defects per million opportunites (2)(4)5.7 defects per million opportunites





- 127. The transportation technique belongs to one of the following mathematical models in operations research
  - Allocation model (1)
  - Queuing model (3)

- Sequencing model (2)
- Inventory model (4)
- 128. The tilting of the front wheels away from the vertical, when viewed from the front of the car is called

(2)

(4)

- (1)Camber
- Toe-in (3)
- 129. The starter motor is driven by
  - Chain drive (1)
  - Flat belt drive (3)

Gear drive (2) V-belt drive (4)

Caster

Toe-out

130. The parking brake generally acts on

- Front wheels (1)
- Front and rear wheels (3)

Rear wheels (2)Propeller shaft (4)

131. The gear shift lever requires two separate motions to shift gears, the first moment

- Selects the synchronizer Moves the synchronizer (2)(1)
- Operates the clutch Meshes the gears (3)(4)

132. The maximum torque multiplication ratio in a torque converter is about

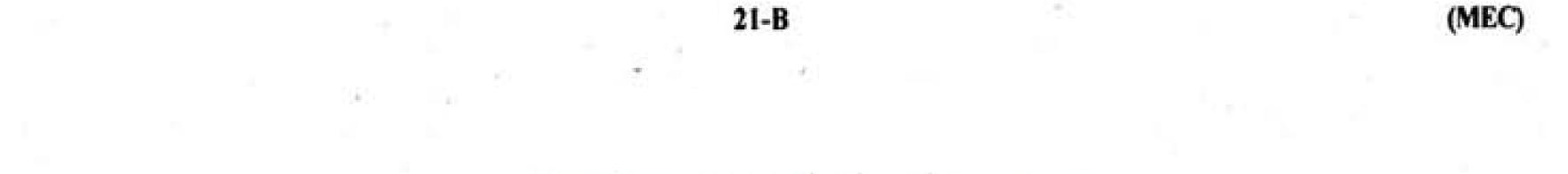
(1) 2.5 (3) 6.5 (4) (2) 4.5 8.5

133. Two speed reverse gear arrangement is generally provided in case of

Metadors Passenger cars (2)(1)Trucks (3)Tractors (4)

134. The component that connects the steering rack to the knuckles is

Sector gear (1)Tie-rod (2)Pivot Spline (3)(4)





135. The operation of cutting of a flat sheet to the desired shape is called

- (1)Shearing
- Punching (3)
- 136. A hacksaw blade is specified by its
  - Length (1)
  - Width (3)

Material (2)

Piercing

Blanking

(2)

(4)

Number of teeth (4)

137. The accuracy of micrometers, calipers and dial indicators can be checked by

- Slip gauge (2)Feeler gauge (1)
- Ring gauge (3)

- Plug gauge (4)

- 138. A sine bar is specified by
  - Centre to centre distance between the rollers
  - Total length (2)
  - Diameter of the rollers (3)
  - Its weight (4)

139. In a carpentry shop, rebating is the process of making

- Convex surfaces (1)
- Circular holes (2)
- A recess on the edge of work piece (3)
- A recess in the middle of work piece (4)

140. Continuous chips with built up edge are formed during machining of

- Ductile metals Brittle metals (2)(1)
- Soft metals Hard metals (4) (3)
- 141. Tumbler gears in lathe are used to
  - Cut gears (1)
  - Drill a hole in work piece (2)
  - Reduce the spindle speed (3)
  - Give desired direction of movement to the lathe carriage (4)

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un which of the following machine, the work is usually rotated while the drill is fed into Work

- (1) Radial drilling machine
- (3) Gang drilling machine

- (2) Sensitive drilling machine
- (4) Deep hole drilling machine

143. 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

144. Internal or external threads of different pitches can be produced by

- (1) Pantograph milling machine
- (3) Plano miller

(2) **Profiling machine** 

(4) Planetary milling machine

- 145. Gear finishing operation is called
  - (1) Shaping
  - (3) Hobbing

### 146. FMS is possible for products

- (1) High volume, low variety, continuous flow
- (2) Low volume, low variety, continuous flow
- (3) Low volume, high variety, intermittent flow
- (4) High volume, high variety, intermittent flow

## 147. CNC drilling machine is considered to be

- (1) P.T.P. controlled machine
- (3) Servo controlled machine
- (2) Continuous path controlled machine
- (4) Adaptive controlled machine
- 148. Seam welding is best adopted for metal thickness ranging from
  - (1)0.025 to 3mm(2)3 to 5mm(3)5 to 8mm(4)8 to 10mm

(2) Milling(4) Burnishing



Set Code : Booklet Code : B

149. In submerged arc welding, an arc is produced between a

- Metal electrode and the work (1)
- Bare metal electrode and the work (2)
- Carbon electrode and the work (3)
- Two tungsten electrodes and the work (4)

150. The commonly used gases in tungsten arc welding arc

- Hydrogen and organ. Hydrogen and oxygen (2)(1)
- Hydrogen and helium (3)

- Helium and argon (4)

- 151. Linde welding uses
  - Neutral flame and rightward technique (1)
  - Carburizing flame and rightward technique (2)
  - Neutral flame and leftward technique (3)
    - Oxidizing flame and leftward technique (4)
- 152. Welding of glass is done by
  - Ultrasonic welding (1)
  - Laser beam welding (3)

- Electron beam welding (2)
- **Explosive welding** (4)
- 153. The cold chisels are made by
  - Piercing Forging (4)(1)Drawing Rolling (2)(3)
- 154. The process extensively used for making bolts and nuts is
  - Extrusion (1)Hot piercing (2) Cold heading (3)Cold peening (4)
- 155. Structural sections such as rails, angles, I-beams are made by
  - Hot drawing (2)Hot rolling (1)Hot extrusion (4)Hot piercing (3)





156. The mode of deformation of the metal during spinning is

- (1) Bending (2) Stretching
- (3) Bending and stretching
- 157. In die casting, machining allowance is
  - (1) Small
  - (3) Very large

(2) Large(4) Not provided

Rolling and stretching

 $\mathbf{x}_{i}$ 

- 158. The property of sand due to which the sand grains stick together, is called
  - (1) Collapsibility
  - (3) Cohesiveness

(2) Permeability(4) Adhesiveness

159. A casting defect which occurs near the ingates as rough lumps on the surface of a casting is

(4)

- known as
- (1) Shift (2) Sandwash (3) Swell (4) Scab
- 160. The symbol used for butt resistance weld is  $(1) \cap (2) \qquad (3) \cap (4)$
- 161. In the drawing of bolted joints, the radius of chamber arc for the bolt nominal diameter of D is
  (1) D
  (2) 1.2D
  (3) 1.5D
  (4) (1.5D+3) mm
- 162. A material is said to be ductile if the elongation is
  - (1) less than 5%
     (2) 5 to 10%
     (3) 10 to 15%
     (4) more than 15%
- 163. The property of the material which enables it to be twisted, bent or stretched under a high stress before rupture is known as
  - (1) Hardness (2) Toughness
  - (3) resilience

(4) Strength





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164. The shock resistance of steel is increased by adding

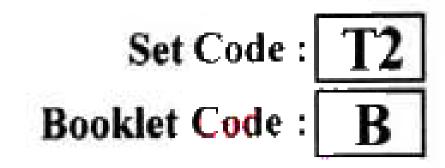
- Nickel (1)
- Nickel and chromium (3)

- Chromium (2)
- Cobalt and molybdenum (4)

165. For hardening alloy steels and high speed steels, they are heated to

- 700 to 900°C (2)500 to 600°C (1)1300 to 1500°C (4) 1100 to 1300°C (3)
- 166. The heat treatment process used for castings is
  - Normalizing (2)Carburizing (1)
  - Tempering (4)Annealing (3)
- 167. The percentage of phosphorus in phosphor bronze is
- (4) 95.3 (3) 11.1 (2) 1 (1) 0.3
- 168. In powder metallurgy the range of pressures to which powdered metals in desired proportions are compressed in moulds is
  - 50 to 300 bar (2)10 to 50 bar (1)
  - 690 to 13750 bar (4)310 to 650 bar (3)
- 169. The angle between two forces to make their resultant a minimum and a maximum respectively are
  - 180° and 90° (2)0° and 90° (1)
  - 180° and 0° 90° and 180° (4) (3)
- 170. The Poisson's ratio for cast iron varies from 0.34 to 0.42 (3) 0.31 to 0.34 (2) 0.25 to 0.33 (4) (1) 0.23 to 0.27
- 171. The point of contraflexure occurs in
  - Simply supported beams (1)
  - Fixed beams (3)

- Cantilever beams (2)
- Overhanging beams (4)



172. 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
- 173. The strain energy stored in a spring, when subjected to maximum load, without suffering permanent distortion, is known as
  - (1) Impact energy
     (2) Proof stress
     (3) Proof resilience
     (4) Modulus of res
  - (3) Proof resilience

- (4) Modulus of resilience
- 174. In a flat belt drive, if the slip between the driver and belt is 1%, between the belt and follower is 3% and driver and follower pulley diameters are equal, then velocity ratio of the drive will be
  (1) 0.96 (2) 0.97 (3) 0.98 (4) 0.99
- 175. The effective stress in wire ropes during normal working is equal to the stress due to
  - (1) Sum of axial load and stress due to bending
  - (2) Sum of acceleration or retardation of masses and stress due to bending
  - (3) Sum of axial load and stress due to acceleration or retardation
  - (4) Sum of bending and stress due to acceleration or retardation
- 176. The centrifugal tension in the belt
  - (1) Increases the power transmitted
  - (2) Decreases the power transmitted
  - (3) Has no effect on the power transmitted
  - (4) Is equal to maximum tension on the belt
- 177. In roller chain the roller diameter is approximately \_\_\_\_\_\_ of the pitch(1) 5/8(2) 6/8(3) 7/8(4) same as that
- 178. Which one of the following springs is used in mechanical wrist watch?
  - (1) Spiral spring
  - (3) Bevel spring

- (2) Torsion spring
- (4) Helical compression spring



### Set Code : Booklet Code : B

- 179. When two non intersecting and non-coplanar shafts are connected by gears, the arrangement is known as
  - (1)Spur gearing
  - (3) Bevel gearing

- Helical gearing (2)
- Spiral gearing (4)

180. The cam follower extensively used in aircraft engines is

- Flat faced follower (1)(2)Knife edge follower Roller follower (3)(4)Spherical faced follower
- 181. The ratio of circumferential stress to longitudinal stress in a thin cylinder subjected to an internal pressure is
  - 1/2(1)(2)(3)(4)

- 182. The bending moment M and a torque T is applied on a solid circular shaft. If the maximum bending -stress equals to maximum shear stress developed, then M is equal to
  - (1)1/2(2)2T (3) (4)4T

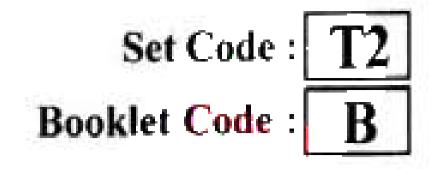
183. In designing a key, it is assumed that the distribution of forces along the length of key

- Varies linearly (1)
- Is uniform through out (2)
- Varies exponentially, being more at the torque input end (3)
- Varies exponentially, being less at the torque input end (4)

### 184. The sleeve or muff coupling is designed as a

- (1)Thin cylinder (2)Thick cylinder (3)Hollow shaft (4)Solid shaft
- 185. Charles' law states that all perfect gases change in volume by of its original volume at 0°C for every 1°C change in temperature, when pressure remains constant (1)1/271/93 (2)1/173 1/273 (3)(4)



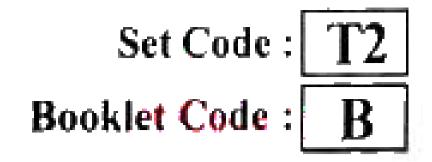


- 186. The isentropic process means
  - (1) Reversible process
  - (3) Reversible adiabatic process
- 187. The hyperbolic law is governed by
  - (1) Gay-Lussac law
  - (3) Boyle's law

- (2) Adiabatic process(4) Irreversible adiabatic process
- (2) Avogadro's law(4) Chales's law
- 188. A thermodynamic cycle consisting of two constant pressure and two isentropic processes is known as
  - (1) Carnot cycle (2) Joule cycle
  - (3) Otto cycle (4) Stirling cycle
- 189. Alpha-methyl-naphthalene has a cetane number of
- 영상이 있습니다. 안전 방법에 걸 것 같아요. 안전에 걸려 알았다. 그는 것이 가지 않는 것을 것 같아요. 가지 못을 것을 많아요.
  - (1) 0 (2) 50 (3) 100 (4) 120
- 190. The inlet valve of a four stroke cycle internal combustion engine remains open for
  - (1)  $150^{\circ}$  (2)  $180^{\circ}$  (3)  $230^{\circ}$  (4)  $280^{\circ}$
- 191. In air standard diesel cycle as the cut of ratio increases keeping the compression ratio same, the efficiency will be
  - (1) Increasing
  - (3) Remains same

- (2) Decreasing
- (4) Tending to the efficiency of Otto cycle
- 192. The aim of providing masked inlet valve in the air passage of compression ignition engines is to
  - (1) Control air flow (2) Enhance flow rate
  - (3) Induce primary swirl (4) Induce secondary turbulence
- 193. A turbo-prop is preferred to turbo-jet because of
  - (1) It's high propulsive efficiency at high speeds
  - (2) It can fly at super sonic speeds.
  - (3) It can fly at high elevations
  - (4) It can have high power for take off





- 194. Separators are generally used in air compressor installations
  - (1) Before the first stage of ompression (2) Before the inter cooler
  - (3) After the inter cooler (4) Between the after cooler and receiver
- 195. In a jet engine the air-fuel ratio is
  - (1) 20:1 (2) 40:1 (3) 60:1 (4) 80:1
- 196. The type of compressor used in gas turbines
  - (1) Reciprocating (2) Axial
  - (3) Centrifugal (4) Radial
- 197. The variation in the volume of a liquid with the variation of pressure is called its
   (1) Capillarity
   (2) Compressibility
  - (3) Surface tension

(4) Viscosity

- 198. The mercury does not wet the glass. This is due to property of liquid known as
  - (1) Cohesion (2) Adhesion
  - (3) Viscocity (4) Surface tension
- 199. The loss of head at exit of a pipe is

(1)  $v^2/2g$  (2)  $0.5 v^2/2g$  (3)  $0.375 v^2/2g$  (4)  $0.75 v^2/2g$ 

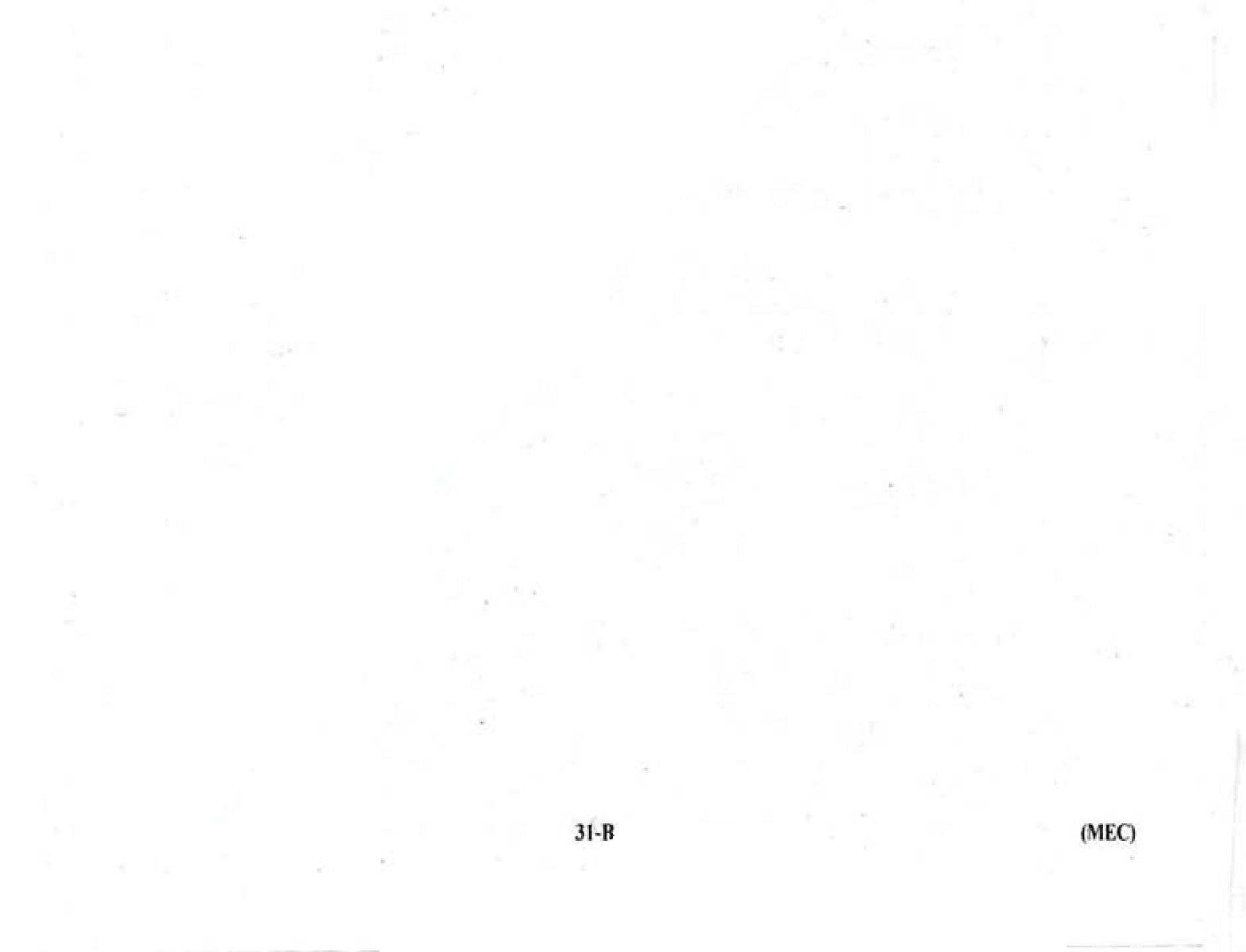
200. A jet of water is striking at the centre of a curved vane moving with a uniform velocity in the direction of jet. For the maximum efficiency, the vane velocity is \_\_\_\_\_\_ of the jet velocity

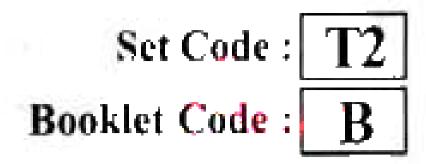
(1)	1/2	(2)	1/3
(3)	2/3	(4)	3/4



# Set Code : T2 Booklet Code : B

### SPACE FOR ROUGH WORK





### SPACE FOR ROUGH WORK



