

MHT CET 2025 Memory Based Question Paper PDF (April 19, 2025) (Shift 1)

1. The ratio of areas bounded by curves $y = \cos x$ and $y = 0$ between $x = 0$ to $x = \frac{\pi}{3}$ and $x = \frac{\pi}{3}$ to $x = \frac{2\pi}{3}$, with the x-axis is:

- (1) 2 : 1
- (2) $\sqrt{2} : 1$
- (3) 1 : 1
- (4) 1 : 3

2. If

$$A = \begin{bmatrix} \cos \theta & \sin \theta & 0 \\ -\sin \theta & \cos \theta & 0 \\ 0 & 0 & 1 \end{bmatrix}$$

and A_{11}, A_{12}, A_{13} are the cofactors of a_{11}, a_{12}, a_{13} respectively, then the value of $a_{11}A_{11} + a_{12}A_{12} + a_{13}A_{13}$ is:

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

3. If $f(x) = 2(\cos x + i \sin x)(\cos 3x + i \sin 3x) \cdots (\cos(2n-1)x + i \sin(2n-1)x)$ where $n \in \mathbb{N}$, then what is the value of $f''(x)$?

- (1) $-n^2 f(x)$
- (2) $n^2 f(x)$
- (3) $-n^4 f(x)$
- (4) $n^4 f(x)$

4. Smallest angle of a triangle whose sides are $6 + \sqrt{12}, \sqrt{48}, \sqrt{54}$ is:

- (1) $\frac{\pi}{4}$
- (2) $\frac{\pi}{2}$
- (3) $\frac{\pi}{6}$
- (4) $\frac{\pi}{3}$

5. A box contains 9 tickets numbered from 1 to 9 inclusive. 3 tickets are drawn from the box one at a time. What is the probability that they are alternatively either (odd, even, odd) or (even, odd, even)?
- (1) $\frac{5}{16}$
(2) $\frac{5}{17}$
(3) $\frac{4}{17}$
(4) $\frac{5}{16}$
6. A plane passes through the point $(1, -2, 1)$ and is perpendicular to both the planes $2x - 2y - 2z = 5$ and $x - y + 2z = 24$. Then, the distance of the point $(1, 2, 2)$ from this plane is:
- (1) $2\sqrt{2}$
(2) 1
(3) $\sqrt{2}$
(4) 2
7. Solve the equation: $x + \log_{15}(5 + 3^x) = x \log_{15} 5 + \log_{15} 24$
- (1) 2
(2) 1
(3) 5
(4) 8
8. An ellipse has OB as the semi-minor axis, and S, S' as the foci. If $\angle SBS'$ is a right angle, then the eccentricity e of the ellipse is:
- (1) $\sqrt{2}$
(2) $\frac{1}{2}$
(3) $\sqrt{\frac{1}{2}}$
(4) $\frac{1}{3}$
9. The value of $\int_1^4 \log(\lfloor x \rfloor) dx$ where $\lfloor x \rfloor$ is the greatest integer less than or equal to x , is:
- (1) $\log 2$
(2) $\log 5$
(3) $\log 6$
(4) $\log 3$

10. In a triangle ABC , with usual notation, if $\frac{b+c}{11} = \frac{c+a}{12} = \frac{a+b}{13}$ then the ratio $\cos A : \cos B : \cos C$ is:
- 19 : 7 : 25
 - 7 : 19 : 25
 - 12 : 14 : 20
 - 19 : 25 : 7
11. The value of $\int_1^4 \log(\lfloor x \rfloor) dx$ where $\lfloor x \rfloor$ is the greatest integer less than or equal to x , is equal to:
- $\log 6$
 - $\log 5$
 - $\log 2$
 - $\log 3$
12. A population $P(t)$ of 1000 bacteria introduced to a nutrient medium grows according to the relation $P(t) = \frac{1000t+1000t}{100+t^2}$. The maximum size of this bacterial population is:
- 1250
 - 1100
 - 1050
 - 950
13. If the angle θ between the line $\frac{2t+1}{1} = \frac{y-1}{2} = \frac{z}{2}$ and the plane $2x - y\sqrt{7} + z + 4 = 0$ is such that $\sin \theta = \frac{8}{\sqrt{3}}$, then the value of the expression is:
- $-\frac{5}{\sqrt{3}}$
 - $\frac{5}{\sqrt{3}}$
 - $\frac{8}{\sqrt{3}}$
 - $-\frac{8}{\sqrt{3}}$
14. The distance of the point $(-3, 2, 3)$ from the line passing through $(4, 6, -2)$ and having direction ratios $-1, 2, 3$ is:
- $4\sqrt{17}$
 - $2\sqrt{17}$
 - $2\sqrt{19}$
 - $4\sqrt{19}$

15. If $y = y(x)$ satisfies $\left(\frac{2+\sin x}{1+y}\right) \frac{dy}{dx} = -\cos x$, such that $y(0) = 2$, then the value of $y\left(\frac{\pi}{2}\right)$ is:
- 3
 - 4
 - 2
 - 1
16. Let $f(x) = (\cos x + \sin x) \cdot \cos(3x + i \sin x) \cdot [(2n-1)x + i \sin((2n-1)x)]$, where $n \in \mathbb{N}$, and $i = \sqrt{-1}$. Then $f''(x) = ?$
- $-n^4 f(x)$
 - $n^2 f(x)$
 - $-n^2 f(x)$
 - $n^4 f(x)$
17. If $[2\vec{p} - 3\vec{q} \vec{q} \vec{s}] + [3\vec{p} + 2\vec{q} \vec{r} \vec{s}] = m[\vec{p} \vec{r} \vec{s}] + n[\vec{q} \vec{r} \vec{s}] + l[\vec{p} \vec{q} \vec{s}]$, then the values of m, n, l respectively are:
- 3, 4, 5
 - 2, 3, 3
 - 1, 2, 3
 - 3, 5, 2
18. Given: $\vec{a} = \hat{j} - \hat{k}$, $\vec{c} = \hat{i} - \hat{j} - \hat{k}$. The vector $\vec{b}$ satisfies $\vec{a} \times \vec{b} + \vec{c} = \vec{0}$ and $\vec{a} \cdot \vec{b} = 3$. Find the vector $\vec{b}$.
- $\vec{b} = -\hat{i} + \hat{j} - 2\hat{k}$
 - $\vec{b} = \hat{i} + \hat{j} + 2\hat{k}$
 - $\vec{b} = \hat{i} - \hat{j} + 2\hat{k}$
 - $\vec{b} = -\hat{i} + \hat{j} + \hat{k}$
19. Evaluate the integral: $\int_{-1}^1 \log\left(\frac{2-x}{2+x}\right) dx$
- $2\log\left(\frac{1}{2}\right)$
 - $\log\left(\frac{3}{4}\right)$
 - 0
 - $\log 2$
20. Find the area bounded between the parabola $y^2 = 4x$ and the line $y = 2x - 3$.

(1) $\int_{1-\sqrt{7}}^{1+\sqrt{7}} \left(\frac{y+3}{2} - \frac{y^2}{4} \right) dy$

(2) $\int_{1-\sqrt{7}}^{1+\sqrt{7}} \left(\frac{y^2}{4} - \frac{y+3}{2} \right) dy$

(3) $\int_{-2}^2 \left(\frac{y^2}{4} - y \right) dy$

(4) $\int_{1-\sqrt{7}}^{1+\sqrt{7}} \left(\frac{y^2+y+3}{2} \right) dy$

21. The magnetic moment of a sample of mass 2 g is $8 \times 10^{-7} \text{ A} \cdot \text{m}^2$. If density $\rho = 4 \text{ g/cm}^3$, then the magnetisation M of the sample is:

(1) 0.4 A/m

(2) 1.6 A/m

(3) 4.0 A/m

(4) 6.4 A/m

22. Which of the following statements is *correct* regarding the coordination compound $[\text{Fe}(\text{CN})_6]^{4-}$ and fructose structure?

(1) The EAN of iron in $[\text{Fe}(\text{CN})_6]^{4-}$ is 36 and fructose forms a pyranose ring.

(2) The EAN of iron in $[\text{Fe}(\text{CN})_6]^{4-}$ is 36 and fructose forms a furanose ring.

(3) The compound exhibits ionisation isomerism and fructose is a non-reducing sugar.

(4) The EAN of Fe is 30 and fructose forms a pyranose ring.

23. The EAN of cobalt in the complex $[\text{Co}(\text{NH}_3)_6]^{3+}$ is:

(1) 27

(2) 30

(3) 33

(4) 36

24. A cube of edge 4 cm has mass 256 g. The density of the material in SI unit is:

(1) 4 kg/m^3

(2) 1600 kg/m^3

(3) 4000 kg/m^3

(4) 1000 kg/m^3

25. A force $F = 5x \text{ N}$ acts on a body and displaces it from $x = 0$ to $x = 2 \text{ m}$. The work done by the force is:

- (1) 10 J
- (2) 20 J
- (3) 5 J
- (4) 15 J

26. The van't Hoff factor for a solution of K_2SO_4 in water is:

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

27. Rosenmund reduction is used to convert acyl chlorides into:

- (1) Alcohols
- (2) Carboxylic acids
- (3) Aldehydes
- (4) Ketones

28. In the electrolysis of molten NaCl, the product obtained at the cathode is:

- (1) Cl_2 gas
- (2) Na metal
- (3) NaOH
- (4) H_2 gas

29. Which of the following is an example of physisorption?

- (1) Adsorption of NH_3 on charcoal
- (2) Adsorption of H_2 on Ni
- (3) Adsorption of noble gases on solid surface
- (4) Adsorption of O_2 on heated metal

30. For a first-order reaction, the time required to reduce the concentration of the reactant to half its initial value is:

- (1) $\frac{0.3010}{k}$
- (2) $\frac{1}{k}$
- (3) $\frac{0.693}{k}$
- (4) $\frac{2.303}{k}$