INSTITUTE OF MATHEMATICS AND APPLICATION

BHUBANESWAR

ENTRANCE TEST FOR ADMISSION INTO B.Sc. (HONOURS) IN MATHEMATICS AND COMPUTING,2025-2026

Iaximum Marks:100 **Time: 2 hours**

INSTRUCTION TO CANDIDATES

- Ensure that this Test Booklet contains 09 printed pages with multiple choice questions.
- Candidates are required to check that the Test Booklet does not have any discrepancy(ies) link unprinted or torn or missing pages,missing questions etc.If so, get it replaced by a complete test booklet before attempting to answer. No extra time will given, if replaced afterwords.
- Each of the questions/incomplete statements is followed by four options/choices marked as (a),(b),(c),(d) under each question/statement,of which only one of them is correct/most appropriate.
- For each question, mark the correct/most appropriate option/choice by putting a cross ($\times$) mark in the appropriate box of the answer sheet provided to you. In case, a candidate feels that there is multiple correct options/choices, the candidate has to mark the option/choice which he/she feels is the most appropriate/best. In any case,only one option/choice has to be marked for each question.More than one option/choice marked in the answer sheet against a question number will be deemed as incorrect.
- If you mark your option/choice at any place other than the box provided, it will not be evaluated.
- Each correct answer carries 2 marks.
- Use of any written/ printed material, calculator, docu-pen, any communication devices like cell phones/i-pads etc,inside the examination hall is not allowed. Candidates found with such items will be reported and his/her candidature will be summarily cancelled.
- Blank sheet(s) for doing rough work/calculations is/are appended at the end of the Test Booklet.
- **Warning: Any malpractice or any attempt to commit any kind of malpractice in the examination hall will disqualify the candidate.**

MULTIPLE - CHOICE QUESTIONS

'hroughout this booklet, $\mathbb{R}$ stands for the set of real numbers and z stands for complex numbers

1. A variable line passing through the point (a, b) meets the coordinate axes at P and Q. The locus of the point of intersection of the lines through P and Q parallel to axes is

(a) $\frac{x}{a} + \frac{y}{b} = 1$ (b) $\frac{x}{b} + \frac{y}{a} = 1$ (c) $\frac{a}{x} + \frac{b}{y} = 1$ (d) $\frac{b}{x} + \frac{a}{y} = 1$

2. If one vertex of an equilateral triangle of side 2 is origin and other vertex lies on the line $x + \sqrt{3}y$ then the third vertex is

(a) $(0, 3)$ (b) $(\sqrt{3}, -1)$ (c) $(1, 3)$ (d) $(-1, \sqrt{3})$

3. A ray of light travelling along the line $x+y=1$ is incident on the $X-$ axis and after refraction it enters the other side of the $X-$ axis by turning $\pi/6$ away from the $X-$ axis. The equation of the line along which the refracted ray travels is

(a) $(2-\sqrt{3})x + y = 1$ (b) $(2+\sqrt{3})x - y = 1$

(c) $y + (2+\sqrt{3})x = 2+\sqrt{3}$ (d) $x + (2-\sqrt{3})y = 1$

4. If one of the lines of $my^2 + (1-m^2)xy - mx^2 = 0$ is a bisector of the angle between the lines $xy = 0$ then m is

(a) 1 (b) 2 (c) - 2 (d) None of these

5. the circle passing through the distinct points $(1, t), (t, 1)$ and (t, t) for all values of t, passes through the point

(a) $(1, -1)$ (b) $(-1, 1)$ (c) $(-1, -1)$ (d) $(1, 1)$

6. The equation to the circle which touches the circle $x^2 + y^2 - 6x + 6y + 17 = 0$ externally and to which the lines $x^2 - 3xy - 3x + 9y = 0$ are normal is

(a) $x^2 + y^2 + 6x + 2y + 1 = 0$ (b) $x^2 + y^2 - 6x + 2y + 1 = 0$

(c) $x^2 + y^2 - 6x - 2y + 1 = 0$ (d) $x^2 + y^2 - 6x - 2y + 1 = 0$

7. The equation to the chord of the hyperbola $25x^2 - 16y^2 = 400$ which is bisected at the point $(5, 3)$ is

(a) $48x + 125y - 481 = 0$ (b) $125x + 48y = 481$

(c) $125x - 48y = 481$ (d) $125x + 48y + 481 = 0$

8. If the tangents drawn from the point $(0, 2)$ to the parabola $y^2 = 4ax$ are inclined at an angle $3\pi/4$ then the value of a is

(a) 2 (b) 3 (c) 4 (d) -3

9. The projection of the point $(1, 1, 1)$ with respect to a plane $2x - 2y + 4z + 2 = 0$ is

(a) $(1/2, -1/2, 1)$ (b) $(1/2, 3/2, 0)$ (c) $(3/2, -1/2, 1)$ (d) $(1, 1/2, 1/2)$

10. The domain of the function $f(x) = log_7 log_2 log_5 x$ is

(a) $(7, \infty)$ (b) $(2, \infty)$ (c) $(5, \infty)$ (d) None of these

11. Let $f(x + y) = f(x)f(y)$ for all x and y. Suppose $f(6) = 4$ and $f'(0) = 5$ then $f'(6)$ is

(a) 24 (b) 30 (c) 20 (d) None of these

12. Let $f(x)$ be a polynomial function of degree 2 and $f(x) > 0$ for all $x \in \mathbb{R}$. If $g(x) = f(x) + f'(x) + f''(x)$ then for any x

(a) $g(x) < 0$ (b) $g(x) > 0$ (c) $g(x) = 0$ (d) None of these

13. If $f(x) = x^3 + x^2 f'(1) + xf''(2) + f'''(3)$ for all $x \in \mathbb{R}$ then

(a) $f(0) + f(2) = 4$ (b) $f(0) - f(2) = 4$

(c) $f(2) + f(3) = 4$ (d) None of these

14. If $f(x-y), f(x)f(y)$ and $f(x+y)$ are in AP for all x and y and $f(0) \neq 0$ then

(a) $f'(2) + f'(-2) = 1$ (b) $f'(1) + f'(-1) = 5$
(c) $f'(3) + f'(-3) = 0$ (d) None of these

15. Let $f(x)$ be a polynomial function of degree 2. If $f(1) = f(-1)$ and a, b, c are in AP then $f'(a), f'(b), f'(c)$ are in

(a) AP (b) GP (c) HP (d) None of these

16. The period of the function $f(x) = 3sin(\pi x/3) + 4cos(\pi x/4)$ is

(a) 12 (b) 6 (c) 24 (d) 8

17. Let f be a function satisfying $f(x+y) = f(x) + f(y)$ for all $x, y \in \mathbb{R}$. If $f(1) = \alpha$ then $f(n)$ for $n \in \mathbb{N}$ is equal to

(a) k^n (b) n^k (c) nk (d) None of these

18. If $f(a) = 2, f'(a) = 1, g(a) = -1, g'(a) = 2$ then $\lim_{x \to a} \frac{g(x)f(a) - g(a)f(x)}{x-a}$ is

(a) 5 (b) -5 (c) 2 (d) -2

19. If $f(x)$ is a polynomial function satisfying $f(x)f(y) = f(x) + f(y) + f(xy) - 2$ for all real x and y and $f(2) = 5$ then $\lim_{x \to 3} f(x)$ is

(a) 9 (b) 10 (c) 20 (d) 25

20. $\lim_{x \to 1} \frac{x sin(x-[x])}{x-1}$, where [.] denotes the greatest integer function, is

(a) 0 (b) 1 (c) -1 (d) None of these

21. If f is continuous and $f(9/2) = 2/9$ then $\lim_{x \to 0} f(\frac{1-cos3x}{x^2})$ is equal to

(a) 2/9 (b) 9/2 (c) 4/9 (d) 9/4

22. A tangent to the curve $y = \int_0^x |t|dt$, which is parallel to the line $y = x$ cuts off an intercept from $y-$ axis is equal to

(a) 1 (b) 1/2 (c) 1/4 (d) 1/3

23. If $y^2 = f(x)$ is a polynomial of degree 3, then $2\frac{d}{dx}(y^3\frac{d^2y}{dx^2})$ is equal to

(a) $f(x) + f''(x)$ (b) $f(x)f''(x)$ (c) $f(x) + f'''(x)$ (d) $f(x)f'''(x)$

24. A sheet of a paper for a poster contains 2 square meters. The margins at the top and bottom are 21 cm and at the sides 14 cms. The dimension of the printed area when the area is minimum is

(a) 2,3 (b) $2/3, \sqrt{3}$ (c) $\sqrt{3}, \frac{2}{\sqrt{3}}$ (d) None of these

25. Let $y_n = \int_0^{\pi/4} tan^n x dx$. Then $y_2 + y_4, y_3 + y_5$ and $y_4 + y_6$ are in

(a) AP (b) GP (c) HP (d) None of these

26. $\int_1^2 \frac{\sqrt{x}}{\sqrt{3-x}+\sqrt{x}}dx$ equal to

(a) 1/3 (b) 1/4 (c) 1/2 (d) 1/5

27. Let $f(x) = ax^3 + bx^2 + cx$ have local extreme values at $x = 1$ and $x = 5$. If $\int\limits_{-1}^{1} f(x)dx = 6$ then

(a) $a = 1$ (b) $b = 2$ (c) $a = -17$ (d)None of these

28. If $f(x) = f(a + x)$ and $\int\limits_{0}^{a} f(x)dx = k$ then $\int\limits_{a}^{na} f(x)dx$ is equal to

(a) nk (b) $(n + 1)k$ (c) $(n - 1)k$ $(n + 2)k$

29. Let $I_1 = \int\limits_{0}^{1} e^{-x^2}dx$, $I_2 = \int\limits_{0}^{1} e^{-x}cos^2xdx$ and $I_3 = \int\limits_{0}^{1} e^{-x^2}cos^2xdx$.Then

(a) $I_1 < I_2 < I_3$ (b) $I_3 < I_2 < I_1$ (c) $I_2 < I_1 < I_3$ (d) $I_2 < I_3 < I_1$

30. If $f : \mathbb{R} \to \mathbb{R}$, $g : \mathbb{R} \to \mathbb{R}$ are continuous, then the value of the integral $\int\limits_{-\pi/2}^{\pi/2} (f(x) + f(-x))(g(x) - g(-x))dx$ is

(a) π (b) 1 (c) -1 (d) 0

31. Four boys picked up 30 mangoes. The number of ways they can divide themselves if all the mangoes are identical is

(a) 5456 (b) 5654 (c) 5546 (d) 6455

32. The number of integral solutions of the system of equations $x_1 + x_2 + x_3 + x_4 + x_5 = 20, x_1 + x_2 = 15$ when $x_k \geq 0$ for $k = 1, 2, 3, 4, 5$ is

(a) 21 (b) 633 (c) 363 (d) 336

33. The number of positive integral solution of $x_1x_2x_3 = 30$ is

(a) 8 (b) 27 (c) 125 (d) 30

34. A box contains two white, three black and four red balls. The number of ways three balls can be drawn from the box so that each contains at least one black ball is

(a) 8 (b)27 (c)64 (d) 125

35. The sum of all five digit numbers which can be formed using the digits $1, 2, 3, 4, 5$ when the digits are not repeated is

(a)3999960 (b) 499690 (c) 6999930 (d) None of these

36. Three dice are thrown. The probability of getting a sum of 15 is

(a) 1/72 (b) 5/108 (c) 7/108 (d) 5/72

37. Let $S = \{2, 3, 4, ..., 20\}$. A number is chosen at random from the set S and it is found to be prime number. The probability that it is more than 10 is

(a) 2/5 (b) 3/5 (c) 1/5 (d) 1/10

38. The remainder when 7^{103} is divided by 25 is

(a) 15 (b) 17 (c) 18 (d) 21

39. If the coefficient of the second, third and fourth terms in the expansion of $(1 + x)^n$ are in AP then the value of n is

(a) 5 (b) 7 (c) 9 (d) 11

40. If $\vec{a}, \vec{b}, \vec{c}$ are three vectors of equal magnitude and the angle between each pair of vectors is $\pi/3$ such

that $|\vec{a}+\vec{b}+\vec{c}|=\sqrt{6}$ then $|\vec{a}|$ is equal to

(a) 2 (b) $\sqrt{6}/2$ (c) 1 (d) $\sqrt{6}$

41. The distance of the point $(1,1,1)$ from the plane passing through the points $(2,1,1),(1,2,1)$ and $(1,1,2)$ is

(a) $2/\sqrt{3}$ (b) $1/\sqrt{3}$ (c) $\sqrt{3}$ (d) 1

42. The equation $|z-i|+|z+i|=k$ represents a hyperbola if

(a) $k>2$ (b) $-2<k,2$ (c) $0<k<2$ (d) None of these

43. The area of a triangle on the argand plane whose vertices are the complex numbers $z, iz, z+iz$ is

(a) $|z|^2$ (b) $\frac{1}{4}|z|^2$ (c) $\frac{1}{3}|z|^2$ (d) $\frac{1}{2}|z|^2$

44. If the vectors $\lambda\vec{i}+\vec{j}+2\vec{k}, \vec{i}+\lambda\vec{j}-\vec{k}$ and $2\vec{i}-\vec{j}+\lambda\vec{k}$ are coplanar then the value of λ is

(a) 2 (b) -2 (c) 3 (d) - 3

45. If $f(x)=\begin{vmatrix} cos(x+x^2) & sin(x+x^2) & -cos(x+x^2) \\ sin(x-x^2) & cos(x-x^2) & sin(x-x^2) \\ sin(2x) & 0 & sin(2x^2) \end{vmatrix}$

then the value of $f'(0)$ is

(a) 3 (b) -3 (c) 2 (d)-2

46. If $f(x)=\begin{vmatrix} 2cos^2x & sin2x & -sinx \\ sin2x & 2sin^2x & cosx \\ sinx & -cosx & 0 \end{vmatrix}$

then $\int\limits_0^{\pi/2}(f(x)+f'(x))dx$ is

(a) $\pi/2$ (b) π (c)$\pi/4$ (d)$\pi/3$

47. If $1 < x < \sqrt{2}$ then the number of solution of the equation $tan^{-1}(x-1) + tan^{-1}x + tan^{-1}(x+1) = tan^{-1}3x$ is

(a) 1 (b) 2 (c) 3 (d) None of these

48. If $0 < a < 5$, $0 < b < 5$ and $\frac{x^2+5}{2} = x - 2cos(a+bx)$ is satisfied for at least one real x then the greatest value of $a+b$ is

(a) $\pi/2$ (b) $3\pi/2$ (c) 3π (d) 4π

49. If $x^2 - ax - 21 = 0$ and $x^2 - 3ax + 35 = 0$ are having a common root then the value of a is

(a) 2 (b) 3 (c) 4 (d) 5

50. $tan(\pi/4 + \frac{1}{2}cos^{-1}x) + tan(\pi/4 - \frac{1}{2}cos^{-1}x), x \neq 0$ is equal to

(a) x (b) $2x$ (c) $2/x$ (d) $x/2$

***** THE END *****