

Roll No _____ (To be filled in by the candidate)

MATHEMATICS (Academic Sessions 2019 – 2021 to 2022 – 2024)

Q.PAPER – I (Objective Type) 223-1st Annual-(INTER PART – I) Time Allowed : 30 Minutes

GROUP – I

Maximum Marks : 20

PAPER CODE = 6195 LHR-11-1-23

Note : Four possible answers A, B, C and D to each question are given. The choice which you think is correct, fill that circle in front of that question with Marker or Pen ink in the answer-book. Cutting or filling two or more circles will result in zero mark in that question.

1-1	Sum of cube roots of unity is : (A) $2i$ (B) -1 (C) 0 (D) 1
2	If ${}^n P_2 = 30$ then $n =$: (A) 5 (B) 6 (C) 7 (D) 8
3	The modulus of complex number $1 - i\sqrt{3}$ is : (A) $1 + i\sqrt{3}$ (B) $-1 + i\sqrt{3}$ (C) 2 (D) $\frac{1}{2}$
4	Arithmetic mean between $\sqrt{2}$ and $3\sqrt{2}$ is : (A) $2\sqrt{2}$ (B) $\sqrt{6}$ (C) $\frac{3}{\sqrt{2}}$ (D) $\frac{\sqrt{2}}{2}$
5	If a function $f: A \rightarrow B$ is such that $\text{Ran } f \subseteq B$ i.e. $\text{Ran } f \neq B$ then f is called : (A) Into function (B) Onto function (C) Injective function (D) Bijective function
6	Partial fractions of $\frac{x^2+1}{(x+1)(x-1)}$ are of the type : (A) $\frac{A}{x+1} + \frac{B}{x-1}$ (B) $1 - \frac{A}{x+1} - \frac{B}{x-1}$ (C) $1 + \frac{A}{x+1} + \frac{B}{x-1}$ (D) $\frac{Ax+B}{x+1} + \frac{C}{x-1}$
7	Quadratic equation whose roots are 2 and 3 : (A) $x^2 - 5x + 6 = 0$ (B) $x^2 + 5x + 6 = 0$ (C) $x^2 - 5x - 6 = 0$ (D) $x^2 + 5x - 6 = 0$
8	If A is a square matrix of order 3 then $ KA =$: (A) $K A $ (B) $K^3 A $ (C) $K^2 A $ (D) $ A $
9	7 th term of the sequence 2, 6, 11, 17, ---- is : (A) 24 (B) 26 (C) 30 (D) 32
10	The trivial solution of homogeneous linear equation is : (A) $(0, 0, 1)$ (B) $(0, 1, 0)$ (C) $(1, 0, 0)$ (D) $(0, 0, 0)$
11	Domain of the function $y = \cot x$ is : (A) $-\infty < x < +\infty$ (B) $-\infty < x < +\infty, x \neq \frac{(2n+1)\pi}{2}, n \in Z$ (C) $-1 \leq x \leq 1$ (D) $-\infty < x < +\infty, x \neq n\pi, n \in Z$

(Turn Over)

CH2-11-1-23 (2)

1-12	If A and B are overlapping events then $P(A \cup B) = \dots$: (A) $P(A) + P(B)$ (B) $1 - P(A)$ (C) $P(A) + P(B) - P(A \cap B)$ (D) $1 - P(B)$
13	The solutions of $\operatorname{cosec} \theta = 2$ which lie in $[0, 2\pi]$: (A) $\frac{4\pi}{3}, \frac{5\pi}{3}$ (B) $\frac{2\pi}{3}, \frac{4\pi}{3}$ (C) $\frac{\pi}{4}, \frac{3\pi}{4}$ (D) $\frac{\pi}{6}, \frac{5\pi}{6}$
14	$\cos\left(\frac{\pi}{2} - \beta\right) = \dots$: (A) $-\sin \beta$ (B) $\sin \beta$ (C) $\cos \beta$ (D) $-\cos \beta$
15	$\cos^{-1}(-x) = :$ (A) $\cos^{-1} x$ (B) $-\cos^{-1} x$ (C) $\pi - \cos^{-1} x$ (D) $2\pi - \cos^{-1} x$
16	2nd term in the expansion of $\left(\frac{a}{2} - \frac{2}{a}\right)^6$ is : (A) $\frac{a^6}{64}$ (B) $\frac{15}{4} a^2$ (C) -20 (D) $-\frac{3}{8} a^4$
17	If $\sin \theta = \frac{12}{13}$ and terminal arm is in quad - I then $\cos \theta = \dots$: (A) $\frac{13}{5}$ (B) $\frac{-5}{13}$ (C) $\frac{5}{13}$ (D) $\frac{-13}{5}$
18	In any triangle with usual notations $\sin \frac{\gamma}{2} = :$ (A) $\sqrt{\frac{(s-a)(s-b)}{ab}}$ (B) $\sqrt{\frac{(s-b)(s-c)}{bc}}$ (C) $\sqrt{\frac{(s-c)(s-a)}{ca}}$ (D) $\sqrt{\frac{s(s-c)}{ab}}$
19	If n is odd in the expansion of $(a+x)^n$ then number of middle term are : (A) 2 (B) 3 (C) 4 (D) 1
20	In law of cosine if $\beta = 90^\circ$ then it reduces to : (A) $b^2 + c^2 = a^2$ (B) $c^2 + a^2 = b^2$ (C) $a^2 + b^2 = c^2$ (D) $c^2 - a^2 = b^2$

SECTION – I

2. Write short answers to any EIGHT (8) questions :

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- (i) Show that $z^2 + \bar{z}^2$ is a real number where $z \in C$
- (ii) Find the multiplicative inverse of $1 - 2i$
- (iii) Write the descriptive and tabular form of $\{x | x \in P \wedge x < 12\}$
- (iv) Define disjunction.
- (v) If a, b are elements of a group G , solve $ax = b$
- (vi) Find x and y if $\begin{bmatrix} x+3 & 1 \\ -3 & 3y-4 \end{bmatrix} = \begin{bmatrix} y & 1 \\ -3 & 2x \end{bmatrix}$
- (vii) Find the cofactors A_{12} and A_{22} if $A = \begin{bmatrix} 1 & -2 & 3 \\ -2 & 3 & 1 \\ 4 & -3 & 2 \end{bmatrix}$
- (viii) Without expansion show that $\begin{vmatrix} 2 & 3 & -1 \\ 1 & 1 & 0 \\ 2 & -3 & 5 \end{vmatrix} = 0$
- (ix) Solve the equation $4^{1+x} + 4^{1-x} = 10$
- (x) Show that the product of all the three cube roots of unity is unity.
- (xi) If α, β are the roots of $ax^2 + bx + c = 0$, $a \neq 0$, find the value of $\alpha^2 + \beta^2$
- (xii) The sum of a positive number and its reciprocal is $\frac{26}{5}$. Find the number.

3. Write short answers to any EIGHT (8) questions :

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- (i) Resolve $\frac{7x+25}{(x+3)(x+4)}$ into partial fraction.
- (ii) If $\frac{1}{a}, \frac{1}{b}$ and $\frac{1}{c}$ are in A.P., show that $b = \frac{2ac}{a+c}$
- (iii) Sum the series $(x-a) + (x+a) + (x+3a) + \dots$ to n terms.
- (iv) Find the 5th term of G.P 3, 6, 12, -----
- (v) If 5 is harmonic mean between 2 and b , find b .
- (vi) Find the sum to n terms of the series whose n th term is $3n^2 + n + 1$
- (vii) Find the value of n when ${}^n P_4 : {}^{n-1} P_3 = 9 : 1$
- (viii) How many necklaces can be made from 6 beads of different colours?
- (ix) Find the value of n , when ${}^n C_{10} = \frac{12 \times 11}{2!}$
- (x) Verify the statement $1 + 2 + 4 + \dots + 2^{n-1} = 2^n - 1$ for $n = 1, 2$
- (xi) Calculate by means of binomial theorem $(0.97)^3$ upto three decimal places.
- (xii) Expand $(1-x)^{\frac{1}{2}}$ upto three terms.

4. Write short answers to any NINE (9) questions :

- (i) Convert 21.256° to the $D^\circ M' S''$ form.
- (ii) Verify $\sin 2\theta = 2 \sin \theta \cos \theta$, when $\theta = 45^\circ$
- (iii) Prove the identity $\cos \theta + \tan \theta \sin \theta = \sec \theta$
- (iv) Prove that $\sin(180^\circ + \alpha) \sin(90^\circ - \alpha) = -\sin \alpha \cos \alpha$
- (v) Prove that $\frac{\cos 11^\circ + \sin 11^\circ}{\cos 11^\circ - \sin 11^\circ} = \tan 56^\circ$
- (vi) Find the values of $\cos 105^\circ$
- (vii) Find the period of $\sin \frac{x}{5}$
- (viii) Find θ , if $\cos \theta = 0.9316$
- (ix) Write any two laws of tangents.
- (x) Find the value of R, if $a = 13$, $b = 14$, $c = 15$
- (xi) Find the value of $\tan \left(\cos^{-1} \frac{\sqrt{3}}{2} \right)$
- (xii) Define trigonometric equation. Give one example.
- (xiii) Find the values of θ , satisfying the equation $2 \sin^2 \theta - \sin \theta = 0$; $\theta \in [0, 2\pi]$

SECTION - II

Note : Attempt any THREE questions.

- 5. (a) Prove that $\begin{vmatrix} b+c & a & a \\ b & c+a & b \\ c & c & a+b \end{vmatrix} = 4abc$ 5
- (b) Solve the equation $x^4 - 3x^3 + 4x^2 - 3x + 1 = 0$ 5
- 6. (a) Resolve into partial fractions $\frac{5x^2 - 2x + 3}{(x+2)^3}$ 5
- (b) Find the value of n and r when ${}^{n-1}C_{r-1} : {}^nC_r : {}^{n+1}C_{r+1} = 3:6:11$ 5
- 7. (a) If $\frac{1}{a}, \frac{1}{b}, \frac{1}{c}$ are in G.P., show that the common ratio is $\pm \sqrt{\frac{a}{c}}$ 5
- (b) Show that $\binom{n}{1} + \binom{n}{3} + \binom{n}{5} + \dots + \binom{n}{n-1} = 2^{n-1}$ 5
- 8. (a) Prove that $\frac{1}{\operatorname{cosec} \theta - \cot \theta} - \frac{1}{\sin \theta} = \frac{1}{\sin \theta} - \frac{1}{\operatorname{cosec} \theta + \cot \theta}$ 5
- (b) Reduce $\sin^4 \theta$ to an expression involving only function of multiples of θ , raised to first power. 5
- 9. (a) Solve the triangle using first law of tangents and then law of sines 5
 $a = 36.21$, $b = 42.09$, $\gamma = 40^\circ 29'$
- (b) Prove that $\sin^{-1} \frac{5}{13} + \sin^{-1} \frac{7}{25} = \cos^{-1} \frac{253}{325}$ 5

Note : Four possible answers A, B, C and D to each question are given. The choice which you think is correct, fill that circle in front of that question with Marker or Pen ink in the answer-book. Cutting or filling two or more circles will result in zero mark in that question.

1-1	The multiplicative inverse of $(1, 0)$ is : (A) 0 (B) 1 (C) $(1, 0)$ (D) $(0, 1)$
2	Which one of them is unary operation : (A) Addition (B) Multiplication (C) Subtraction (D) Negation
3	If A is a square matrix of order 3×3 then $ KA =$: (A) $K A $ (B) $K^2 A $ (C) $K^3 A $ (D) $K^9 A $
4	A square matrix $A = [a_{ij}]$ is called a skew-symmetric if : (A) $A^t = A$ (B) $A^t = -A$ (C) $A^t = \pm A$ (D) $A^{-1} = A$
5	Roots of quadratic equation $x^2 - 7x + 10 = 0$ are : (A) 2, 5 (B) -2, 5 (C) 2, -5 (D) -2, -5
6	Product of all three cube roots of unity is : (A) i (B) $-i$ (C) 1 (D) -1
7	Types of rational fractions are : (A) 1 (B) 2 (C) 3 (D) 4
8	A.M. between $x-3$ and $x+5$ is : (A) $x+1$ (B) $2x+1$ (C) $2x+2$ (D) 2
9	G.M. between 1 and 16 is : (A) -5 (B) 4 (C) 6 (D) 8
10	$P(E)$ represents the probability of an event "E" and $0 \leq P(E) \leq 1$ for $P(E) = 0$ the event will be : (A) Certain (B) One (C) Possible (D) Impossible
11	The probability that an event does not occur, $P(\bar{E}) =$: (A) $1 - P(E)$ (B) $1 + P(E)$ (C) $2 - P(E)$ (D) $2 + P(E)$
12	The total number of terms in the expansion of $(a+x)^n$ is : (A) $n+2$ (B) $n+1$ (C) n (D) $n-1$
13	The statement $n^2 > n+3$ hold for $n =$: (A) 0 (B) 1 (C) 2 (D) 3

14	$\frac{2\pi}{3}$ radian in degree is :	(A) 75°	(B) 100°	(C) 110°	(D) 120°
15	$1 - 2\sin^2 \alpha = :$	(A) $\sin 2\alpha$	(B) $\sin \frac{\alpha}{2}$	(C) $\cos 2\alpha$	(D) $\cos \alpha$
16	The period of tangent function is :	(A) $\frac{\pi}{4}$	(B) $\frac{\pi}{2}$	(C) $\frac{\pi}{3}$	(D) π
17	$\sqrt{s(s-a)(s-b)(s-c)} = :$	(A) r	(B) Δ	(C) Δs	(D) r_1
18	$\frac{\Delta}{s} = :$	(A) r	(B) r_1	(C) r_2	(D) r_3
19	$\cos^{-1}\left(\frac{1}{2}\right) = :$	(A) $\frac{\pi}{3}$	(B) $\frac{\pi}{4}$	(C) $\frac{\pi}{6}$	(D) $\frac{\pi}{2}$
20	Solution of the equation $\sin x = \frac{1}{2}$ in $[0, 2\pi]$ is :	(A) $\frac{\pi}{2}$	(B) $\frac{\pi}{6}$	(C) $\frac{\pi}{4}$	(D) $\frac{\pi}{3}$

2. Write short answers to any EIGHT (8) questions :

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- (i) Show that $\forall z \in C, (z - \bar{z})^2$ is a real number.
- (ii) Simplify $(a + bi)^{-2}$
- (iii) Write the power set of $\{+, -, \times, \div\}$
- (iv) Write the converse, inverse of $\sim p \rightarrow q$
- (v) Just, convert $(A \cup B)' = A' \cap B'$ and $(A \cap B)' = A' \cup B'$ into logical form.
- (vi) If $A = \begin{bmatrix} 1 & 2 \\ a & b \end{bmatrix}$ and $A^2 = \begin{bmatrix} 0 & 0 \\ 0 & 0 \end{bmatrix}$, find the values of a and b
- (vii) Solve the equations $2x_1 - 3x_2 = 5$
 $5x_1 + x_2 = 4$
- (viii) Define cofactor of an element of matrix.
- (ix) Solve the equation $x^3 + x^2 + x + 1 = 0$
- (x) If α, β are the roots of $x^2 - px - p - c = 0$, prove that $(1 + \alpha)(1 + \beta) = 1 - c$
- (xi) Discuss the nature of roots $2x^2 - 5x + 1 = 0$
- (xii) Give the statement of factor theorem.

3. Write short answers to any EIGHT (8) questions :

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- (i) Without finding constants, write $\frac{9x-7}{(x^2+1)(x+3)}$ into partial fraction form.
- (ii) If $a_{n-3} = 2n - 5$, find n th term of A.P.
- (iii) Sum the series $3 + 5 - 7 + 9 + 11 - 13 + 15 + 17 - 19 + \dots + 3n$ terms.
- (iv) If $\frac{1}{a}, \frac{1}{b}$ and $\frac{1}{c}$ are in G.P, then show that common ratio is $\pm \sqrt{\frac{a}{c}}$
- (v) If 5 is the H.M. between 2 and b , find the value of b .
- (vi) Write formula for $\sum_{k=1}^n k$ and $\sum_{k=1}^n k^3$
- (vii) If ${}^{11}P_n = 11.10.9$, then find n
- (viii) How many signals can be given by 5 flags of different colours using 3 flags at a time?
- (ix) A die is thrown twice. What is the probability that sum of dots shown is either 3 or 11?
- (x) Using binomial theorem, expand $\left(3a - \frac{x}{3a}\right)^4$
- (xi) Find middle term in the expansion of $\left(\frac{x}{2} + \frac{2}{x^2}\right)^{12}$
- (xii) Expand $(1 - 2x)^{\frac{1}{3}}$ upto first three terms.

4. Write short answers to any NINE (9) questions :

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- (i) Define angle in the standard position.
- (ii) If $\tan \theta = -\frac{1}{3}$ and the terminal arm of angle is in second quadrant then find $\sec \theta$
- (iii) Find $\sin \theta$ and $\cos \theta$ for $\theta = \frac{19\pi}{3}$
- (iv) If α, β, γ are angles of triangle ABC then prove $\sin(\alpha + \beta) = \sin \gamma$
- (v) Without calculator or table, find $\cos(75^\circ)$
- (vi) Prove that $\tan(45^\circ + A) \tan(45^\circ - A) = 1$
- (vii) Define period of a trigonometric function.
- (viii) Solve the right triangle ABC in which $r = 90^\circ, a = 3.28, b = 5.74$
- (ix) By using the law of cosine, write the formula of $\cos \alpha$ and $\cos \beta$
- (x) Solve the triangle ABC if $\beta = 60^\circ, \gamma = 15^\circ$ and $b = \sqrt{6}$
- (xi) Define the principal sin function.
- (xii) Solve the equation $\sin x = \frac{1}{2}$
- (xiii) Solve the equation $\sin x + \cos x = 0$ and find its general solution set.

SECTION - II

Note : Attempt any THREE questions.

5. (a) If $A = \begin{bmatrix} i & 1+i \\ 1 & -i \end{bmatrix}$ show that $A - (\bar{A})^t$ is skew-hermitian. 5
- (b) When $x^4 + 2x^3 + kx^2 + 3$ is divided by $x - 2$ and remainder is 1, find the value of k. 5
6. (a) Resolve into partial fraction $\frac{1}{(x-1)^2(x+1)}$ 5
- (b) Prove that ${}^n C_r + {}^n C_{r-1} = {}^{n+1} C_r$ 5
7. (a) Find 'n' so that $\frac{a^{n+1} + b^{n+1}}{a^n + b^n}$ may be H.M. between a and b 5
- (b) Find $(2n+1)$ th term from the end in expansion of $\left(x - \frac{1}{2x}\right)^{3n}$ 5
8. (a) If $\tan \theta = \frac{1}{\sqrt{7}}$ and the terminal arm of the angle is not in the III quad., find the value of $\frac{\operatorname{cosec}^2 \theta - \sec^2 \theta}{\operatorname{cosec}^2 \theta + \sec^2 \theta}$ 5
- (b) Prove that $\cos 20^\circ \cos 40^\circ \cos 60^\circ \cos 80^\circ = \frac{1}{16}$ 5
9. (a) Solve the triangle ABC if $a = 7, b = 3, \gamma = 38^\circ 13'$ 5
- (b) Prove that $\tan^{-1} \frac{3}{4} + \tan^{-1} \frac{3}{5} - \tan^{-1} \frac{8}{19} = \frac{\pi}{4}$ 5