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 (HR-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 $f: A \to B$ is such that Ran $f \subseteq B$ i.e. 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 $\lvert KA\rvert$ = : (A) $K\lvert A\rvert$ (B) $K^3\lvert A\rvert$ (C) $K^2\lvert A\rvert$ (D) $\lvert A\rvert$
9	7th 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) $-\infty < x < +\infty$, $x \neq n\pi$, $n \in Z$

CHR-11-I-23 (2)

1-12	If A and B are overlapping events then $P(A \cup B) = ---$: (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	$\cos\left(\frac{\pi}{2}-\beta\right) = ---$: (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 $\cos\theta = ---$: (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 $\beta = 90°$ 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) $c^2-a^2=b^2$

Roll No LHR-11-1-23 (To be filled in by the candidate)

(Academic Sessions 2019 – 2021 to 2022 – 2024)

MATHEMATICS 223-1st Annual-(INTER PART – I) Time Allowed : 2.30 hours

PAPER – I (Essay Type) GROUP – I Maximum Marks : 80

SECTION – I

2. Write short answers to any EIGHT (8) questions : **16**

(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 $\{x \mid x \in P \wedge x < 12\}$

(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 : **16**

(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 $(x-a) + (x+a) + (x+3a) + \text{----}$ 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 nth 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 $1 + 2 + 4 + \text{------} + 2^{n-1} = 2^n - 1$ for $n = 1, 2$

(xi) Calculate by means of binomial theorem $(0.97)^3$ upto three decimal places.

(xii) Expand $(1-x)^{1/2}$ upto three terms.

(Turn Over)

CHL-11-1-23 (2)

4. Write short answers to any NINE (9) questions : **18**

(i) Convert $21.256°$ to the $D°M'S''$ form.

(ii) Verify $\sin 2\theta = 2\sin\theta\cos\theta$, when $\theta = 45°$

(iii) Prove the identity $\cos\theta + \tan\theta\sin\theta = \sec\theta$

(iv) Prove that $\sin(180° + \alpha)\sin(90° - \alpha) = -\sin\alpha\cos\alpha$

(v) Prove that $\dfrac{\cos 11° + \sin 11°}{\cos 11° - \sin 11°} = \tan 56°$

(vi) Find the values of $\cos 105°$

(vii) Find the period of $\sin\dfrac{x}{5}$

(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 $\tan\left(\cos^{-1}\dfrac{\sqrt{3}}{2}\right)$

(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 $\dfrac{5x^2 - 2x + 3}{(x+2)^3}$ 5

(b) Find the value of n and r when ${}^{n-1}C_{r-1} : {}^{n}C_{r} : {}^{n+1}C_{r+1} = 3:6:11$ 5

7. (a) If $\dfrac{1}{a}, \dfrac{1}{b}, \dfrac{1}{c}$ are in G.P. , show that the common ratio is $\pm\sqrt{\dfrac{a}{c}}$ 5

(b) Show that $\binom{n}{1} + \binom{n}{3} + \binom{n}{5} + \text{------} + \binom{n}{n-1} = 2^{n-1}$ 5

8. (a) Prove that $\dfrac{1}{\operatorname{cosec}\theta - \cot\theta} - \dfrac{1}{\sin\theta} = \dfrac{1}{\sin\theta} - \dfrac{1}{\operatorname{cosec}\theta + \cot\theta}$ 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
$a = 36.21$, $b = 42.09$, $\gamma = 40°29'$

(b) Prove that $\sin^{-1}\dfrac{5}{13} + \sin^{-1}\dfrac{7}{25} = \cos^{-1}\dfrac{253}{325}$ 5

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 – II Maximum Marks : 20

PAPER CODE = 6192 LHR-11-2-23

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	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 $\lvert KA \rvert$ = :			
	(A) $K\lvert A\rvert$	(B) $K^2\lvert A\rvert$	(C) $K^3\lvert A\rvert$	(D) $K^9\lvert A\rvert$
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 $0 \le P(E) \le 1$ 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) $\frac{\pi}{3}$

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

(Academic Sessions 2019 – 2021 to 2022 – 2024)

MATHEMATICS 223-1st Annual-(INTER PART – I) Time Allowed : 2.30 hours

PAPER – I (Essay Type) GROUP – II Maximum Marks : 80

SECTION – I CHR-11-2-23

2. Write short answers to any EIGHT (8) questions : **16**

(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 : **16**

(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 nth term of A.P.

(iii) Sum the series 3 + 5 – 7 + 9 + 11 – 13 + 15 + 17 – 19 + --- + 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 $(1-2x)^{1/3}$ upto first three terms.

LHR-II-2-23

4. Write short answers to any NINE (9) questions : 18

(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 $\cos(75°)$

(vi) Prove that $\tan(45° + A)\tan(45° - A) = 1$

(vii) Define period of a trigonometric function.

(viii) Solve the right triangle ABC in which $r = 90°$, $a = 3.28$, $b = 5.74$

(ix) By using the law of cosine , write the formula of cosα and cosβ

(x) Solve the triangle ABC if $\beta = 60°$, $\gamma = 15°$ 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 ${}^nC_r + {}^nC_{r-1} = {}^{n+1}C_r$ 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 $\cos 20° \cos 40° \cos 60° \cos 80° = \frac{1}{16}$ 5

9. (a) Solve the triangle ABC if $a = 7$, b = 3 , $\gamma = 38°13'$ 5

(b) Prove that $\tan^{-1}\frac{3}{4} + \tan^{-1}\frac{3}{5} - \tan^{-1}\frac{8}{19} = \frac{\pi}{4}$ 5