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

MATHEMATICS **(Academic Sessions 2020 – 2022 to 2023 – 2025)**

Q.PAPER – I (Objective Type) 224-1st Annual-(INTER PART – I) Time Allowed : 30 Minutes

GROUP – I Maximum Marks : 20

PAPER CODE = 6195 1 HR - 1-24

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	Rank of the matrix $\begin{bmatrix} 1 \\ 0 \\ -1 \end{bmatrix}$ is :			
	(A) 0	(B) 1	(C) 2	(D) 3
2	The fraction $\frac{x+1}{x^2+2}$ is :			
	(A) Improper fraction	(B) Proper fraction	(C) Identity	(D) Mixed
3	The multiplicative inverse of (1 , 0) is :			
	(A) (1 , 0)	(B) (0 , 1)	(C) (– 1 , 0)	(D) (0 , – 1)
4	The roots of $2x^2 - 7x + 3 = 0$, are :			
	(A) Equal	(B) Complex	(C) Irrational	(D) Rational
5	The value of $(-i)^9$ is :			
	(A) – 1	(B) 1	(C) i	(D) – i
6	If A is a square matrix of order 3 and $\lvert A \rvert = 2$, then $\lvert 2A \rvert =$:			
	(A) 16	(B) 8	(C) 6	(D) 2
7	The number of elements of the power set of A = { a, { b , c } } are :			
	(A) 2	(B) 4	(C) 6	(D) 8
8	If $A \subseteq B$, then :			
	(A) $A \cup B = A$	(B) $A \cap B = B$	(C) $B \cup A = A$	(D) $A \cup B = B$
9	If ω is a cube root of unity, then value of $(1+\omega-\omega^2)^3$ is :			
	(A) 8ω	(B) $8\omega^2$	(C) – 8	(D) 8
10	The converse of $\sim p \rightarrow q$ is :			
	(A) $p \rightarrow q$	(B) $p \rightarrow \sim q$	(C) $\sim q \rightarrow p$	(D) $q \rightarrow \sim p$
11	$\cos 2\theta =$:			
	(A) $1 - \sin^2\theta$	(B) $1 - 2\sin\theta$	(C) $1 - 2\sin^2\theta$	(D) $2\sin^2\theta - 1$
12	The G.M. between $\frac{1}{a}$ and $\frac{1}{b}$ is :			
	(A) $\pm\sqrt{ab}$	(B) $\pm\frac{1}{ab}$	(C) $\pm\sqrt{\frac{1}{ab}}$	(D) ab

1-13	If $\cos x = -\frac{\sqrt{3}}{2}$, then the reference angle is : (A) $\frac{\pi}{3}$ (B) $\frac{\pi}{6}$ (C) $-\frac{\pi}{3}$ (D) $-\frac{\pi}{6}$
14	If $\sin\theta < 0$ and $\cot\theta > 0$, then θ lies in quadrant : (A) IV (B) III (C) II (D) I
15	The value of $\sin^{-1}(\cos\frac{\pi}{6})$ is equal to : (A) $\frac{\pi}{3}$ (B) $\frac{\pi}{6}$ (C) $\frac{\pi}{2}$ (D) $\frac{3\pi}{2}$
16	The relation between A, G, H is : (A) $G^2 = AH$ (B) $H^2 = AG$ (C) $A^2 = HG$ (D) $A > G < H$
17	The number of terms in the expansion of $(a+x)^n$ is : (A) n – 1 (B) n (C) n + 2 (D) n + 1
18	$\sqrt{\frac{s(s-c)}{ab}} =$: (A) $\cos\frac{\alpha}{2}$ (B) $\sin\frac{\alpha}{2}$ (C) $\cos\frac{\gamma}{2}$ (D) $\sin\frac{\gamma}{2}$
19	A die is thrown, what is the probability to get 3 dots : (A) $\frac{1}{6}$ (B) $\frac{1}{3}$ (C) $\frac{1}{2}$ (D) $\frac{2}{3}$
20	The period of $\cos\frac{x}{6}$ is : (A) 2π (B) 3π (C) 6π (D) 12π

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(Academic Sessions 2020 – 2022 to 2023 – 2025)

MATHEMATICS 224-1st Annual-(INTER PART – I) Time Allowed : 2.30 hours

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

SECTION – I

LHR-1-24

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

(i) Write the symmetric property and transitive property of equality of the real numbers.

(ii) Show that $z\bar{z} = |z|^2 \ \forall z \in C$

(iii) Find out real and imaginary parts of $(\sqrt{3}+i)^3$

(iv) Find the modulus of $1-i\sqrt{3}$

(v) Construct truth table for $(p \wedge \sim p) \rightarrow q$

(vi) If a, b are elements of a group G, then show that $(ab)^{-1} = b^{-1}a^{-1}$

(vii) 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.

(viii) If A and B are square matrices of the same order, then explain why in general $(A-B)^2 \neq A^2 - 2AB + B^2$.

(ix) Define skew-hermitain matrix.

(x) Evaluate $\omega^{28} + \omega^{29} + 1$

(xi) When $x^4 + 2x^3 + kx^2 + 3$ is divided by $x-2$, the remainder is 1. Find the value of k.

(xii) If α, β are the roots of $x^2 - px - p - c = 0$, prove that $(1+\alpha)(1+\beta) = 1-c$

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

(i) Define partial fractions.

(ii) If $\frac{7x+25}{(x+3)(x+4)} = \frac{4}{x+3} + \frac{B}{x+4}$, then find B.

(iii) Find the number of terms in A.P if $a_1 = 3$; $d = 7$ and $a_n = 59$

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

(v) Find the sum of $\frac{9}{4} + \frac{3}{2} + 1 + \frac{2}{3} + - - - - - \infty$

(vi) If 5 is H.M. between 2 and b, then find b.

(vii) Write $\frac{(n+1)(n)(n-1)}{3.2.1}$ in factorial form.

(viii) Prove that ${}^nP_r = n \cdot {}^{n-1}P_{r-1}$

(ix) Determine probability of getting 2 heads in two successive tosses of balanced coin.

(x) Show that $8.10^n - 2$ is divisible by 6 for n = 1 and n = 2

(xi) Find the 6th term in the expansion of $\left(x^2 - \frac{3}{2x}\right)^{10}$

(xii) Using binomial theorem, find value of $\sqrt[3]{65}$ correct to three places of decimal.

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

(i) Verify $\tan 2\theta = \frac{2\tan\theta}{1-\tan^2\theta}$ for $\theta = 45°$

(ii) Prove the identity $\frac{1+\cos\theta}{1-\cos\theta} = (\cos ec\theta + \cot\theta)^2$

(iii) If α, β and γ are the angles of triangle ABC then prove that $\tan(\alpha+\beta) - \tan\gamma = 0$

(iv) Express as product $\cos 6\theta + \cos 3\theta$

(v) Prove that $1 + \tan\alpha \tan 2\alpha = \sec 2\alpha$

(vi) Prove that period of cosine is 2π

(vii) Find the period of $\cos ec\, 10x$

(viii) Draw the graph of the function $y = \cos x,\ x\,t\left[-\frac{\pi}{2}, \frac{\pi}{2}\right]$

(ix) Write formula for $\cos\frac{\alpha}{2}$ and $\cos\frac{\gamma}{2}$

(x) Measure of two sides of a triangle are in the ratio 3 : 2 and angle including these sides is $57°$. Find the remaining two angles.

(xi) Define circum centre.

(xii) Without using calculator / table, show that $2\cos^{-1}\frac{4}{5} = \sin^{-1}\frac{24}{25}$

(xiii) Solve the trigonometric equation $\cos ec^2\theta = \frac{4}{3}$

SECTION – II

Note : Attempt any THREE questions.

5. (a) Show that $\begin{vmatrix} a+\lambda & b & c \\ a & b+\lambda & c \\ a & b & c+\lambda \end{vmatrix} = \lambda^2(a+b+c+\lambda)$ 5

(b) If the roots of the equation $x^2 - px + q = 0$ differ by unity, prove that $p^2 = 4q+1$ 5

6. (a) Resolve $\frac{1}{(x-3)^2(x+1)}$ into partial fractions 5

(b) Find n so that $\frac{a^n + b^n}{a^{n-1} + b^{n-1}}$ may be the A.M. between a and b 5

7. (a) Two dice are thrown. E_1 is the event that the sum of their dots is an odd numbers and E_2 is the event that 1 is the dot on the top of the first die. Show that $P(E_1 \cap E_2) = P(E_1)\ .\ P(E_2)$ 5

(b) If $y = \frac{1}{3} + \frac{1.3}{2!}\left(\frac{1}{3}\right)^2 + \frac{1.3.5}{3!}\left(\frac{1}{3}\right)^3 + ----$ prove that $y^2 + 2y - 2 = 0$ 5

8. (a) Reduce $\sin^4\theta$ to an expression involving only function of multiple of θ, raised to the first power. 5

(b) Prove that $\Delta = r^2 \cot\frac{\alpha}{2}\cot\frac{\beta}{2}\cot\frac{\gamma}{2}$ 5

9. (a) Find the values of all the trigonometric functions of the angle $-675°$. 5

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

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Q.PAPER – I (Objective Type) 224-1st Annual-(INTER PART – I) Time Allowed : 30 Minutes

GROUP – II Maximum Marks : 20

PAPER CODE = 6196 LHR-2-24

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	If A is a matrix of order 2×3, then order of A^tA is :			
	(A) 3×3	(B) 2×3	(C) 3×2	(D) 2×2
2	The equation $x(x-1)=x^2-x$ is :			
	(A) Conditional	(B) Identity	(C) Exponential	(D) Radical
3	The multiplicative inverse of $-i$ is :			
	(A) $(1,-1)$	(B) $(0,-1)$	(C) $(0,1)$	(D) $(1,0)$
4	If ω is a cube root of unity, then $(1+\omega+\omega^2)^8 =$:			
	(A) 0	(B) 256	(C) 256ω	(D) $256\omega^2$
5	Which of the following sets has closure property w.r.t. addition :			
	(A) $\{1\}$	(B) $\{0\}$	(C) $\{0,1\}$	(D) $\{1,-1\}$
6	If $\lvert A\rvert=9$, then $\lvert A^t\rvert$ is :			
	(A) 81	(B) $\frac{1}{9}$	(C) -9	(D) 9
7	The converse of $p \rightarrow q$ is :			
	(A) $\sim p \rightarrow \sim q$	(B) $\sim q \rightarrow p$	(C) $q \rightarrow p$	(D) $p \rightarrow \sim q$
8	If $A=\{\}$, then the power set of A is :			
	(A) ϕ	(B) $\{0\}$	(C) $\{\}$	(D) $\{\phi\}$
9	If $4^{1+x}=2$, then $x=$:			
	(A) 0	(B) -2	(C) $-\frac{1}{2}$	(D) $\frac{1}{2}$
10	If $A \cap B = A$, then :			
	(A) $B \subseteq A$	(B) $A \subseteq B$	(C) $A \cup B = A$	(D) $B \cup A = A$
11	$\sin(270^\circ+\theta)=$:			
	(A) $\sin\theta$	(B) $\cos\theta$	(C) $-\cos\theta$	(D) $-\sin\theta$
12	Which cannot be the term of a G.P. :			
	(A) 1	(B) -1	(C) 0	(D) i

(Turn Over)

1-13	If $\sin x = -\frac{\sqrt{3}}{2}$, then the reference angle is : (A) $-\frac{\pi}{6}$ (B) $\frac{\pi}{6}$ (C) $-\frac{\pi}{3}$ (D) $\frac{\pi}{3}$
14	Which angle is quadrantal angle : (A) 45° (B) 60° (C) 120° (D) 270°
15	With usual notation, $\frac{abc}{4R} =$: (A) r (B) r_1 (C) Δ (D) r_2
16	H.M. between 3 and 7 is : (A) 5 (B) $\sqrt{21}$ (C) $\pm\sqrt{21}$ (D) $\frac{21}{5}$
17	The number of terms in the expansion of $(a+x)^n$ is : (A) n – 1 (B) n (C) n + 2 (D) n + 1
18	The period of $\cos 2x$ is : (A) π (B) 2π (C) 4π (D) $\frac{\pi}{2}$
19	If r = n, then ${}^nC_r =$: (A) 0 (B) 1 (C) n (D) n!
20	$\sin^{-1}(0) + \cos^{-1}(0) =$: (A) 0 (B) $\frac{\pi}{2}$ (C) $\frac{\pi}{3}$ (D) $\frac{\pi}{4}$

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MATHEMATICS 224-1st Annual-(INTER PART – I) Time Allowed : 2.30 hours

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

SECTION – I

LHR-2-24

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

(i) Show that $z^2\bar{z}^2$ is a real number.

(ii) Find the modulus of $1-i\sqrt{3}$

(iii) Simplify by justifying each step $\dfrac{\frac{1}{4}+\frac{1}{5}}{\frac{1}{4}-\frac{1}{5}}$

(iv) Check the closure property w.r.t. addition and multiplication for the set $\{0, -1\}$

(v) Determine whether the statement $p \wedge \sim p$ is tautology or not.

(vi) Define semi-group.

(vii) If $A=\begin{bmatrix}1\\1+i\\i\end{bmatrix}$, find $A(\bar{A})^t$

(viii) Define reduced echelon form of a matrix, with example.

(ix) If $A=\begin{bmatrix}2 & -1\\3 & 1\end{bmatrix}$, verify that $(A^{-1})^t=(A^t)^{-1}$

(x) Discuss nature of roots of $9x^2-12x+4=0$

(xi) Solve the equations $x^2+y^2=25$, $2x^2+3y^2=6$

(xii) Find the condition that one root of $x^2+px+q=0$ is square of other.

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

(i) Define proper rational fraction.

(ii) For the identity $\dfrac{1}{(x-1)(2x-1)(3x-1)}=\dfrac{A}{x-1}+\dfrac{B}{2x-1}+\dfrac{C}{3x-1}$ calculate the value of A.

(iii) Find the next two terms of 1, 3, 7, 15, 31, ----

(iv) How many terms are there in the A.P. in which $a_1=11$, $a_n=68$, $d=3$

(v) Find three A.Ms between $\sqrt{2}$ and $3\sqrt{2}$.

(vi) Find the 12th term of $1+i$, $2i$, $-2+2i$, -----

(vii) Show that ${}^{16}C_{11}+{}^{16}C_{10}={}^{17}C_{11}$

(viii) Evaluate ${}^{12}C_3$

(ix) What is sample space and events?

(x) State principle of mathematical induction.

(xi) Calculate $(9.98)^4$ by means of binomial theorem.

(xii) Prove that $n!>2^n-1$ for $n=4,5$

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

(i) What is length of an arc intercepted on a circle of radius 14 cm by the arms of a central angle 45^o?

(ii) Convert $54°45'$ into radians.

4. (iii) If α, β, γ are angles of triangle ABC then prove that $\cos\left(\frac{\alpha+\beta}{2}\right)=\sin\frac{\gamma}{2}$

(iv) Find the value of $\cos\frac{\pi}{12}$

(v) Express $\sin(x+30°)+\sin(x-30°)$ as a product.

(vi) Define periodic function and period of trigonometric function.

(vii) Find period of $\cos\frac{x}{6}$

(viii) Draw the graph of $y=\sin x$ from 0 to π.

(ix) State law of sines.

(x) If sides of triangle are 16, 20, 23, find its greatest angle.

(xi) Show that $r_1 = s\tan\frac{\alpha}{2}$

(xii) Find value of $\cos\left(\sin^{-1}\frac{1}{\sqrt{2}}\right)$

(xiii) Show that $\tan\left(\sin^{-1}x\right)=\frac{x}{\sqrt{1-x^2}}$

SECTION – II

Note : Attempt any THREE questions.

5. (a) Solve the system of equations by Cramer's rule : 5

$$2x+2y+z=3$$
$$3x-2y-2z=1$$
$$5x+y-3z=2$$

(b) If α, β roots of $x^2-3x+5=0$ form the equation whose roots are $\frac{1-\alpha}{1+\alpha}$ and $\frac{1-\beta}{1+\beta}$ 5

6. (a) Resolve $\frac{x^4}{1-x^4}$ into partial fractions 5

(b) The sum of an infinite geo-metric series is 9 and the sum of the squares of its terms is $\frac{81}{5}$. Find the series. 5

7. (a) Find the values of n and r when ${}^{n-1}C_{r-1} : {}^{n}C_{r} : {}^{n+1}C_{r+1} = 3:6:11$ 5

(b) If x is so small that its cube and higher powers can be neglected, then show that : $\sqrt{\frac{1-x}{1+x}} \approx 1-x+\frac{x^2}{2}$ 5

8. (a) Reduce $\cos^4\theta$ to an expression involving only function of multiples of θ, raised to the first power. 5

(b) Prove that $r_3 = 4R\cos\frac{\alpha}{2}\cos\frac{\beta}{2}\sin\frac{\gamma}{2}$ 5

9. (a) Show that the area of a sector of a circular region of radius r is $\frac{1}{2}r^2\theta$, where θ is the circular measure of the central angle of the sector. 5

(b) Prove that $\sin^{-1}\frac{1}{\sqrt{5}}+\cot^{-1}3=\frac{\pi}{4}$ 5