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

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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.

(Turn Over)

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

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

(ii) Prove the identity $\dfrac{1+\cos\theta}{1-\cos\theta} = (\operatorname{cosec}\theta + \cot\theta)^2$

(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 $\operatorname{cosec} 10x$

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

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

(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 $2\cos^{-1}\dfrac{4}{5} = \sin^{-1}\dfrac{24}{25}$

(xiii) Solve the trigonometric equation $\operatorname{cosec}^2\theta = \dfrac{4}{3}$

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 $\dfrac{1}{(x-3)^2(x+1)}$ into partial fractions 5

(b) Find n so that $\dfrac{a^n + b^n}{a^{n-1} + b^{n-1}}$ 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 $y = \dfrac{1}{3} + \dfrac{1.3}{2!}\left(\dfrac{1}{3}\right)^2 + \dfrac{1.3.5}{3!}\left(\dfrac{1}{3}\right)^3 + ----$ 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 $\Delta = r^2 \cot\dfrac{\alpha}{2}\cot\dfrac{\beta}{2}\cot\dfrac{\gamma}{2}$ 5

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

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

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