LHR-G1-11.19

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

MATHEMATICS (Academic Sessions 2015 – 2017 to 2018 – 2020)

Q.PAPER – I (Objective Type) 219-(INTER PART – I) GROUP – I

Time Allowed : 30 Minutes
Maximum Marks : 20

PAPER CODE = 6195

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 $x-a$ is a factor of polynomial $f(x)$, then $f(a)$ is :	(A) $=0$	(B) <0	(C) >0	(D) $\neq 0$
2	If ${}^nC_5 = {}^nC_4$, then n is :	(A) 9	(B) 7	(C) 6	(D) 5
3	The multiplicative inverse of (1 , – 2) = :	(A) $(\frac{1}{5},\frac{-2}{5})$	(B) $(\frac{-1}{5},\frac{-2}{5})$	(C) $(\frac{1}{5},\frac{2}{5})$	(D) $(\frac{-1}{5},\frac{2}{5})$
4	9th term in the sequence $\frac{1}{3},\frac{1}{5},\frac{1}{7},----$ is :	(A) $\frac{1}{13}$	(B) $\frac{1}{15}$	(C) $\frac{1}{17}$	(D) $\frac{1}{19}$
5	The contrapositive of $\sim p \to \sim q$ is :	(A) $p \to q$	(B) $q \to p$	(C) $\sim q \to \sim p$	(D) $\sim q \to p$
6	From the identity $5x+4 = A(x-1)+B(x+2)$, then value of B = :	(A) -3	(B) 3	(C) -2	(D) 2
7	The sum of four 4th roots of 16 is :	(A) 0	(B) 2	(C) 4	(D) 16
8	If $\begin{bmatrix} x-3 & 1 \\ -5 & -4 \end{bmatrix} = \begin{bmatrix} 2 & 1 \\ -5 & -4 \end{bmatrix}$, then $x =$:	(A) 5	(B) -5	(C) -1	(D) 1
9	The arithmetic mean between $\sqrt{2}$ and $3\sqrt{2}$ is :	(A) $3\sqrt{2}$	(B) $2\sqrt{2}$	(C) $4\sqrt{2}$	(D) $\sqrt{2}$
10	If $A = \begin{bmatrix} 1 & 2 & -2 \\ 0 & 0 & 5 \\ 6 & 7 & 3 \end{bmatrix}$, then $A_{33} =$:	(A) -1	(B) 1	(C) 3	(D) 0
11	Period of $\cot\theta$ is :	(A) π	(B) 2π	(C) $\frac{\pi}{2}$	(D) $\frac{3\pi}{2}$

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1-12	Number of signals can be made with 4 flags when one flag is used at a time are : (A) ${}^4C_0$ (B) ${}^4C_1$ (C) ${}^4C_2$ (D) ${}^4C_3$
13	The equation $\sin^2 x - \sec x = \frac{3}{4}$ is called : (A) Trigonometric equation (B) Linear equation (C) Quadratic equation (D) Quantic equation
14	$3\sin\alpha - 4\sin^3\alpha =$: (A) $\sin\alpha$ (B) $\sin 2\alpha$ (C) $\sin 3\alpha$ (D) $\sin 4\alpha$
15	Domain of the function $y = \sin^{-1} x$ is : (A) $-\frac{\pi}{2} \le x \le \frac{\pi}{2}$ (B) $-1 \le y \le 1$ (C) $-1 \le x \le 1$ (D) $-\frac{\pi}{2} \le y \le \frac{\pi}{2}$
16	Francesco Mourolico devised the method of : (A) Partial fraction (B) Induction (C) Logarithms (D) Binomial
17	If $\ell = 35$ cm and $\theta = 1$ rad, then r = : (A) 35° (B) 35 cm (C) 35 rad (D) 35 m
18	In any ΔABC with usual notations , $\frac{\Delta}{s-c} =$: (A) r (B) r_1 (C) r_2 (D) r_3
19	The general term in the expansion of $(a+x)^n$ is : (A) $\binom{n}{a} a^{n-r} x^r$ (B) $\binom{n}{x} a^{n-r} x^r$ (C) $\binom{n}{r} a^{n-r} x^r$ (D) $\binom{n}{r} a^{n-r} x$
20	If sides of a ΔABC are $a = 4584$, b = 5140 and c = 3624, then greatest angle will be : (A) α (B) β (C) γ (D) a

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(Academic Sessions 2015 – 2017 to 2018 – 2020)

MATHEMATICS 219-(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) If z_1 and z_2 are complex numbers then show that $\overline{z_1+z_2} = \overline{z_1} + \overline{z_2}$

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

(iii) Factorize a^2+4b^2

(iv) Define power set of a set and give an example.

(v) Define a bijective function.

(vi) Construct truth table and show that the statement $\sim(p \to q) \to p$ is a tautology or not.

(vii) Find the matrix X if $X\begin{bmatrix} 5 & 2 \\ -2 & 1 \end{bmatrix} = \begin{bmatrix} -1 & 5 \\ 12 & 3 \end{bmatrix}$

(viii) For the matrix $A = \begin{bmatrix} 1 & -2 & 3 \\ -2 & 3 & 1 \\ 4 & -3 & 2 \end{bmatrix}$ find cofactor A_{12}

(ix) Without expansion show that $\begin{vmatrix} \alpha & \beta+\gamma & 1 \\ \beta & \gamma+\alpha & 1 \\ \gamma & \alpha+\beta & 1 \end{vmatrix} = 0$

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

(xi) If α, β are the roots of $ax^2+bx+c=0$, $a \neq 0$ then find the value of $\alpha^2+\beta^2$

(xii) The sum of a positive number and its square is 380. Find the number.

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

(i) Define partial fraction.

(ii) In the identity $7x+25 = A(x+4) + B(x+3)$, calculate values of A and B.

(iii) Resolve $\frac{1}{x^2-1}$ into partial fractions.

(iv) Write the first four terms of the sequence, if $a_n - a_{n-1} = n+2$, $a_1 = 2$

(v) Which term of the arithmetic sequence 5, 2, – 1, ---- is – 85.

(vi) Find three A.Ms between 3 and 11.

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

(viii) Insert two G.Ms between 2 and 16.

(ix) Find the value of n when ${}^nC_{10} = \frac{12 \times 11}{2!}$

(x) Show that $\frac{n^3+2n}{3}$ represents an integer for n = 2, 3.

(xi) Expand $\left(1-\frac{3}{2}x\right)^{-2}$ upto 4 terms.

(xii) If x is so small that its square and higher power can be neglected, then show that $\frac{\sqrt{1+2x}}{\sqrt{1-x}} \approx 1+\frac{3}{2}x$

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

(i) Find ℓ, if $\theta = 65^\circ 20'$, r = 18 mm

(ii) Prove $\sin^2\frac{\pi}{6} : \sin^2\frac{\pi}{4} : \sin^2\frac{\pi}{3} : \sin^2\frac{\pi}{2} = 1:2:3:4$

(iii) Prove $\cos^2\theta - \sin^2\theta = \frac{1-\tan^2\theta}{1+\tan^2\theta}$

(iv) Prove that $\tan 56^\circ = \frac{\cos 11^\circ + \sin 11^\circ}{\cos 11^\circ - \sin 11^\circ}$

(v) Prove $\frac{1-\cos\alpha}{\sin\alpha} = \tan\frac{\alpha}{2}$

(vi) Prove $\cos 20^\circ + \cos 100^\circ + \cos 140^\circ = 0$

(vii) Find the period of $\tan\frac{x}{7}$

(viii) In ΔABC, $\beta = 60^\circ$, $\gamma = 15^\circ$, $b = \sqrt{6}$, find c.

(ix) If $a = 200$, b = 120 , $\gamma = 150^\circ$, find the area of a triangle ABC

(x) Prove that $r_1 r_2 r_3 = rs^2$

(xi) Prove $\sin(2\cos^{-1}x) = 2x\sqrt{1-x^2}$

(xii) Solve $1 + \cos x = 0$

(xiii) Find the solutions of $\sin x = -\frac{\sqrt{3}}{2}$ in $[0, 2\pi]$

SECTION – II

Note : Attempt any THREE questions.

5. (a) Prove that all 2 × 2 non-singular matrices over the real field form a non-abelian group under multiplication. 5

(b) Find three, consecutive numbers in G.P whose sum is 26 and their product is 216. 5

6. (a) Find the inverse of the matrix $A = \begin{bmatrix} 2 & 5 & -1 \\ 3 & 4 & 2 \\ 1 & 2 & -2 \end{bmatrix}$ by using row operation. 5

(b) Prove that ${}^nC_r + {}^nC_{r-1} = {}^{n+1}C_r$ 5

7. (a) Solve the system of equations :

$12x^2 - 25xy + 12y^2 = 0$

$4x^2 + 7y^2 = 148$ 5

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

8. (a) Prove that $\sqrt{\frac{1-\sin\theta}{1+\sin\theta}} = \sec\theta - \tan\theta$ where θ is not an odd multiple of $\frac{\pi}{2}$ 5

(b) If α, β, γ are the angles of a triangle ABC, then show that :

$\cot\frac{\alpha}{2} + \cot\frac{\beta}{2} + \cot\frac{\gamma}{2} = \cot\frac{\alpha}{2}\cot\frac{\beta}{2}\cot\frac{\gamma}{2}$ 5

9. (a) The sides of a triangle are $x^2 + x + 1$, $2x + 1$ and $x^2 - 1$. Prove that the greatest angle of the triangle is 120°. 5

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

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oll No ______________________ (To be filled in by the candidate)

(Academic Sessions 2015 – 2017 to 2018 – 2020)

MATHEMATICS 219-(INTER PART – I) Time Allowed : 2.30 hours

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

SECTION – I

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

(i) Prove the rule of addition $\frac{a}{c}+\frac{b}{c}=\frac{a+b}{c}$

(ii) Find the multiplicative inverse of $\left(\sqrt{2}\,,-\sqrt{5}\right)$

(iii) Express the complex number $1+i\sqrt{3}$ in polar form.

(iv) Write the power set of $\{a,\{b,c\}\}$

(v) Show that the statement $p\rightarrow(p\vee q)$ is tautology.

(vi) Prove that the identity element e in a group G is unique.

(vii) If $A=\begin{bmatrix}1 & -1\\ a & b\end{bmatrix}$ and $A^2=\begin{bmatrix}1 & 0\\ 0 & 1\end{bmatrix}$, find a and b

(viii) If $B=\begin{bmatrix}5 & -2 & 5\\ 3 & -1 & 4\\ -2 & 1 & -2\end{bmatrix}$. find cofactor B_{21}

(ix) If A is a skew-symmetric matrix, then show that A^2 is a symmetric matrix

(x) Solve $x^{-2}-10=3x^{-1}$.

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

(xii) Discuss the nature of roots of the equation $x^2-5x+6=0$

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

(i) Define proper fraction.

(ii) If $\frac{x^2-10x+13}{(x-1)(x^2-5x+6)}=\frac{A}{x-1}+\frac{B}{x-2}+\frac{C}{x-3}$, find value of A

(iii) If $\frac{x}{(x-a)(x-b)(x-c)}=\frac{A}{x-a}+\frac{B}{x-b}+\frac{C}{x-c}$, find value of B

(iv) If the numbers $\frac{1}{k}$, $\frac{1}{2k+1}$ and $\frac{1}{4k-1}$ are in harmonic sequence, find k

(v) Find sum of infinite geometric series 2 + 1 + 0.5 + ----

(vi) Define geometric mean.

(vii) If 5, 8 are two A.Ms between a and b, find a and b

(viii) If $\frac{1}{a}$, $\frac{1}{b}$ and $\frac{1}{c}$ are in A.P, show that $b=\frac{2ac}{a+c}$

(ix) Prove that ${}^nC_r={}^nC_{n-r}$

(x) Expand $(1+x)^{\frac{-1}{3}}$ upto 3 terms.

(xi) Evaluate $\sqrt[3]{30}$ correct to three places of decimal.

(xii) Check whether the statement 5^n-2^n is divisible by 3 for n = 2 , 3 is true or false.

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

(i) Find r , when $\ell = 56cm, \theta = 45°$

(ii) Find the values of all trigonometric functions for -15π

(iii) Prove that $\frac{1-\sin\theta}{\cos\theta} = \frac{\cos\theta}{1+\sin\theta}$

(iv) Express the difference $\cos 7\theta - \cos\theta$ as product.

(v) Prove $\frac{1-\cos\alpha}{\sin\alpha} = \tan\frac{\alpha}{2}$

(vi) Find the value of $\cos 105°$ without using calculator.

(vii) Find the period of $3\sin\frac{2x}{5}$

(viii) With usual notations prove that $\frac{1}{r} = \frac{1}{r_1} + \frac{1}{r_2} + \frac{1}{r_3}$

(ix) Define in-circle of the triangle ABC.

(x) State the law of tangent. (any two)

(xi) Show that $\cos(2\sin^{-1}x) = 1 - 2x^2$

(xii) Solve the equation for $\theta \in [0, \pi]$ $\cot^2\theta = \frac{4}{3}$

(xiii) Solve the equation for $\theta \in [0, \pi]$ $2\sin\theta + \cos^2 - 1 = 0$

SECTION – II

Note : Attempt any THREE questions.

5. (a) If G is a group under the operation " ※ " and $a, b \in G$, find the solutions of the equations : (i) $a ※ x = b$ (ii) $x ※ a = b$ 5

(b) If 7^{th} and 10^{th} terms of an H.P are $\frac{1}{3}$ and $\frac{5}{21}$ respectively, find its 14^{th} term 5

6. (a) Show that $\begin{vmatrix} a+\ell & a & a \\ a & a+\ell & a \\ a & a & a+\ell \end{vmatrix} = \ell^2(3a+1)$ 5

(b) Prove that ${}^{n-1}C_r + {}^{n-1}C_{r-1} = {}^nC_r$ 5

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

(b) Use mathematical induction to prove that $n! > n^2$ for integral values of $n \geq 4$. 5

8. (a) A railway train is running on a circular track of radius 500 meters at the rate of 30 km per hour. Through what angle will it turn in 10 sec? 5

(b) Reduce $\sin^4\theta$ to an expression involving only function of multiples of θ raised to the first power. 5

9. (a) Prove that $r_1r_2 + r_2r_3 + r_3r_1 = s^2$ 5

(b) Prove that $\tan^{-1}A + \tan^{-1}B = \tan^{-1}\frac{A+B}{1-AB}$ 5

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MATHEMATICS **(Academic Sessions 2015 – 2017 to 2018 – 2020)**

Q.PAPER – I (Objective Type) 219-(INTER PART – I) Time Allowed : 30 Minutes

GROUP – II Maximum Marks : 20

PAPER CODE = 6194

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	$\cos\left(\frac{3\pi}{2}-\theta\right)$ is equal to : (A) $-\sin\theta$ (B) $\sin\theta$ (C) $\cos\theta$ (D) $-\cos\theta$
2	Probability of impossible event is : (A) $\frac{1}{2}$ (B) 1 (C) 0 (D) 2
3	$2\tan^{-1}A$ equals : (A) $\tan^{-1}\left(\frac{A}{1-A^2}\right)$ (B) $\tan^{-1}\left(\frac{2A}{1-A^2}\right)$ (C) $\tan^{-1}\left(\frac{2A}{1+A^2}\right)$ (D) $\tan^{-1}\left(\frac{A}{1+A^2}\right)$
4	Which angle is quadrantal angle : (A) 45° (B) 60° (C) 270° (D) 120°
5	Solution of equation $\tan x = \frac{1}{\sqrt{2}}$ lies in the quadrants : (A) I and II (B) II and III (C) I and III (D) I and IV
6	Middle terms in the expansion of $(x+y)^{11}$ are : (A) T_6, T_7 (B) T_5, T_6 (C) T_7, T_8 (D) T_8, T_9
7	If Δ is the area of a triangle ABC, then with usual notation $\Delta =$: (A) $\frac{1}{2}bc\sin\beta$ (B) $\frac{1}{2}ab\sin\alpha$ (C) $\frac{1}{3}bc\sin\alpha$ (D) $\frac{1}{2}bc\sin\alpha$
8	Range of cotangent function is : (A) N (B) Z (C) R (D) C
9	Expansion of $(3-5x)^{\frac{1}{2}}$ is valid if : (A) $\lvert x\rvert < \frac{3}{5}$ (B) $\lvert x\rvert < \frac{5}{3}$ (C) $\lvert x\rvert < 5$ (D) $\lvert x\rvert < 3$
10	With usual notation R = : (A) $\frac{b}{2\sin\gamma}$ (B) $\frac{a}{2\sin\alpha}$ (C) $\frac{c}{2\sin\alpha}$ (D) $\frac{a}{2\sin\beta}$
11	The sum of the four fourth roots of 81 is : (A) 0 (B) 81 (C) -81 (D) 3

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1-12	The property $\forall a,b \in \mathbb{R}$, $a=b \Rightarrow b=a$ is called : (A) Commutative (B) Transitive (C) Symmetric (D) Reflexive
13	The value of 4! . 0! . 1! is : (A) 0 (B) 1 (C) 4 (D) 24
14	A square matrix $A=[a_{ij}]$ in which $a_{ij}=0$ for all $i>j$ is called : (A) Upper triangular (B) Lower triangular (C) Symmetric (D) Skew-symmetric
15	$\sum_{k=1}^{n}(1)^k =$: (A) $\frac{n(n-1)}{2}$ (B) $\frac{n}{2}$ (C) n (D) $\frac{n(n+1)}{2}$
16	If $b^2-4ac>0$ but not a perfect square, then roots are : (A) Equal (B) Complex (C) Rational (D) Irrational
17	No term of geometric sequence can be : (A) 0 (B) 1 (C) 2 (D) 3
18	If A and B are two sets, then A – B = : (A) $A \cup B^c$ (B) $A \cap B^c$ (C) $(A \cup B)^c$ (D) $(A \cap B)^c$
19	Partial fractions of $\frac{1}{x^3-1}$ will be of the form : (A) $\frac{A}{x+1}+\frac{Bx+C}{x^2+x+1}$ (B) $\frac{A}{x-1}+\frac{Bx+C}{x^2+x+1}$ (C) $\frac{A}{x-1}+\frac{Bx+C}{x^2-x+1}$ (D) $\frac{A}{x+1}+\frac{Bx+C}{x^2-x+1}$
20	If $A=[a_{ij}]_{2\times 2}$, then $\lvert kA \rvert =$: (A) $\lvert A \rvert$ (B) $k^2 \lvert A \rvert$ (C) $k \lvert A \rvert$ (D) $k \lvert A \rvert^2$