Sig. of Supdt.....

KT-XI-1901

Mathematics (Part – I)
Fresh/Reappear

Roll No.....

Fic. No.....

Fic. No.....

Time allowed: 3 Hrs **Mathematics (Part – I)** **Marks: 100**

Fresh / Reappear **Code - A**

Note: There are three sections of the paper, A, B & C. Attempt Section – A on the same paper and return it to the superintendent within the given time. Mobile phone etc. are not allowed in the examination hall.

Time: 20 Mins **Section "A"** **Marks: 20**

Q.1 Write the correct option i.e. A, B, C or D in the empty box provided opposite to each part. No marks will be awarded for cutting, erasing or over writing.

i. If $Z + \bar{Z} = 0$ then Z is ..... **A**
A. Real B. Imaginary C. 1 D. 9

ii. The $x + iy$ form of $(1-3i)^{-1}$ is ..... **A**
A. $\frac{1}{10}+\frac{3}{10}i$ B. $-\frac{1}{10}-\frac{3}{10}i$ C. $\frac{3}{10}-\frac{3}{10}i$ D. $\frac{1}{3}+\frac{3}{5}i$

iii. ${}^{n}P_4 = 6\,({}^{n}P_3)$, then n = ... **C**
A. 14 B. 1 C. 9 D. 11

iv. $n! > n^2$ holds if ..... **D**
A. $n \in N$ B. $n \geq 2$ C. $n \geq 3$ D. $n \geq 4$

v. $\vec{i} \cdot \vec{i} \times \vec{k} =$ ..... **B**
A. 0 B. 1 C. -1 D. k^2

vi. If $y = \frac{x}{3} + \frac{x^2}{3^2} + \frac{x^3}{3^3} + \ldots\ldots$ where $0 < x < 3$ then x = ... **A**
A. $\frac{3y}{1+y}$ B. $\frac{1+y}{3y}$ C. y^2 D. $3y^n$

vii. If $\begin{vmatrix} x-2 & 1 \\ 5 & x+2 \end{vmatrix} = 0$ then x = ... **D**
A. 0 B. 3 C. -3 D. ±3

viii. Geometric Means between the numbers $\sqrt{5}-4$ and $\sqrt{5}+4$ is ..... **C**
A. 4 B. -1 C. Does not exist D. ±3

ix. The general term of the sequence -1, 1, -1, 1, ... **B**
A. $(-1)^{n+1}$ B. $(-1)^n$ C. $(-1)^{2n}$ D. -n

x. ${}^{n+2}C_8 + {}^{n+2}C_7$ = ... **A**
A. ${}^{n+3}C_8$ B. ${}^{n+2}C_7$ C. ${}^{n+4}C_8$ D. 1

xi. Solution of the inequality $x - 5 > 0$ is ..... **C**
A. R B. $x \geq 5$ C. $x > 5$ D. $x < 5$

xii. $2\,\text{Sin}^2(\beta/2)$ = ... **B**
A. Cosβ B. 1-Cosβ C. 1 + Cosβ D. $\text{Cos}^2\,\beta/2$

xiii. The graph of an odd function is symmetric about ..... **C**
A. X-axis B. Y-axis C. Origin D. Line y = x

xiv. If θ is in 3rd Quadrant then θ/2 will be in ..... **B**
A. 1st Quadrant B. 2nd Quadrant C. 3rd Quadrant D. 4th Quadrant

xv. If M_{ij} is a minor of an entry a_{ij} of a square matrix A, then the Cofactor A_{ij} = ... **C**
A. $(-1)^{i+j} M_{ji}$ B. $(-1)^{i+j} M_{ij}$ C. $(-1)^{i+j} M_{ij}$ D. $(-1)^{i} M_{j}$

xvi. The value $r_1 r_2 + r_2 r_3 + r_3 r_1$ = ... **B**
A. R^2 B. S^2 C. Δ^2 D. Does not exist

xvii. $\text{Sin}^{-1}(1/2)$ = ... **C**
A. π B. $\pi/3$ C. $\pi/6$ D. $\frac{\pi}{4}$

xviii. Which one of the following function is Odd. **C**
A. $y = x^2 + 2$ B. $y = 2x + 6x^3$ C. y = Sin x D. $y = (x+1)^2$

xix. $\frac{b^2 - a^2 - c^2}{2ac}$ = ... **D**
A. Cosβ B. Cosα C. Cosγ D. -Cosβ

xx. $\sum_{k=1}^{n} k^3$ = ... **C**
A. $\frac{n(n+1)}{2}$ B. $\frac{n(n+1)^2}{4}$ C. $\left[\frac{n(n+1)}{2}\right]^2$ D. $\frac{n(n+1)(2n+1)}{6}$

Time: 2:40 Hours

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Section "B"

Marks: 50

Q.2 Attempt any TEN parts. All parts carry equal marks.

i. Separate real and imaginary parts of complex number $\left(\frac{5-2i}{2+3i}\right)^{-1}$

ii. Solve for x, $\begin{vmatrix} -1 & 0 & 1 \\ x^2 & 1 & x \\ 2 & 3 & 4 \end{vmatrix} = -6$

iii. Find the projection of the vector $\mathbf{a} = \mathbf{i} - 2\mathbf{j} + \mathbf{k}$ on the vector $\mathbf{b} = 4\mathbf{i} - 4\mathbf{j} + 7\mathbf{k}$.

iv. Find the sum of all the numbers divisible by 5 from 25 through 350.

v. Sum the series. 1.5.9 + 2.6.10 + 3.7.11 + ... to n. terms.

vi. Find the value of n. $\frac{n(n!)}{(n-5)!} = \frac{12(n!)}{(n-4)!}$

vii. If x is nearly equal to unity then show that $px^p - qx^q = (p-q)x^{p+q}$

viii. If two dice are rolled. Find the probability of obtaining a total of 7 or 11.

ix. Prove that $\cos 3\alpha(1-2\sin\alpha) = \cos 3\alpha - (\sin 4\alpha - \sin 2\alpha)$

x. What is the vertex angle of an isosceles triangle whose equal sides are 13 ft long. If the area is 50 ft^2.

xi. Write $\mathrm{Cos}(\mathrm{Sin}^{-1}x)$ as an algebraic expression.

xii. Minimize $f(x, y) = 3x + 4y$ subject to the constraints $2x + 3y \geq 6$, $x + y \leq 8$, $x \geq 0$, $y \geq 0$

xii. Find the point of intersection of the functions graphically f(x) = 3x – 2, g(x) = -x + 6

Section "C"

Marks: 30

Note: Attempt any THREE questions. All questions carry equal marks.

Q.3 a. If x^4 and higher power are neglected then show that $(1+x)^{1/4} + (1-x)^{1/4} = a - bx^2$. Also find a and b.

b. Find the value of λ if A is singular $A = \begin{vmatrix} -\lambda & 1 & 0 \\ 1 & -\lambda & 1 \\ 0 & 1 & -\lambda \end{vmatrix}$

Q.4 a. Determine whether the function. $f(x) = x\sqrt{x^2+3}$ is even, odd or neither.

b. Show that $Tan^{-1}x + Tan^{-1}\frac{1}{x} = \frac{\pi}{2}$

Q.5 a. Let $A = \begin{bmatrix} 2 & 3 \\ -1 & 1 \end{bmatrix}$ verify that $\left(A^{-1}\right)^t = \left(A^t\right)^{-1}$

b. Solve the quadratic equation $2z^2 + 15 = 4z$

Q.6 a. For the vectors: $\mathbf{a} = 3\mathbf{i} + 2\mathbf{k}$, $\mathbf{b} = \mathbf{i} + 2\mathbf{j} + \mathbf{k}$, $\mathbf{c} = -\mathbf{j} + 4\mathbf{k}$ Verify that $\mathbf{a}.\mathbf{b} \times \mathbf{c} = \mathbf{c}.\mathbf{a} \times \mathbf{b}$

b. For what value of n, $\frac{a^{n+1} + b^{n+1}}{a^n + b^n}$ is the Geometric Mean between a and b.

where a and b are not zero simultaneously.