Serial No. Of the Answer Book 251
Roll No. (in figure)_____
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**Superintendent Seal & Signature** FIC. No (For office use only)

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# MATHEMATICS (Fresh) - I

**Total Time: 3 Hours** **Max: Marks: 100**

**Note: There are THREE Sections of this Paper i.e. A.B and C, attempt each according to the given instructions.**

**Time: 20 Minutes** **SECTION-A** **Marks: 20**

**Note:** Attempt all parts of Section -- A. Section –A must be return to the superintendent after 20 minutes even if you have not attempted any question. Overwriting/ defacing/Cutting etc. is prohibited in Section-A and no credit will be given to such answer.

**I. Write the correct option i.e. A/B/C/D in the empty boxes.**

i. $(-i)^{23} =$ _____. B

(A) $-i$ (B) $i$ (C) 1 (D) $-1$

ii. Let z be a complex number and $\overline{Z}$ is its conjugate, then $Z\overline{Z}$ = _____. C

(A) $|z|$ (B) $(z)^2$ (C) $|Z|^2$ (D) $(z)^{1/2}$

iii. A square matrix $A = \begin{bmatrix} -2 & 0 \\ 0 & 4 \end{bmatrix}$ is a _____matrix. D

(A) Scalar (B) Row (C) Column (D) Diagonal

iv. In matrix multiplication the _____property does not hold. B

(A) Associative (B) Commutative (C) Distributive (D) None of these

v. Let $\hat{a}$ be a unit vector of vector $\vec{a}$ then $\hat{a}$ =_____. C

(A) $\vec{a}.|a|$ (B) $\frac{|a|}{\vec{a}}$ (C) $\frac{\vec{a}}{|a|}$ (D) $\vec{a}+|a|$

vi. If $\alpha$, $\beta$, and $\gamma$ are the direction angles of a vector, then $Cos^2\alpha + Cos^2\beta + Cos^2\gamma$ = _____. A

(A) 1 (B) 0 (C) -1 (D) None of these

vii. If $\vec{a}$ and $\vec{b}$ are two vectors, then the length of $(\vec{a} \times \vec{b})$ is $|\vec{a} \times \vec{b}|$ = _____. B

(A) $|a||b|\cos\theta$ (B) $|a||b|\sin\theta$ (C) $|a||b|\cos\theta\hat{n}$ (D) $|a||b|\sin\theta\hat{n}$

viii. The fourth term of $a_n = (-1)^n \frac{(n+1)}{n}$ is _____. D

(A) $\frac{-4}{3}$ (B) $\frac{3}{2}$ (C) $-\frac{6}{5}$ (D) $\frac{5}{4}$

ix. The geometric mean of two number 9 and 16 is G = _____. B

(A) 144 (B) 12 (C) 5 (D) $\frac{25}{2}$

x. Let A, G and H be the Arithmetic, geometric and Harmonic mean respectively then $G^2$ = _____. A

(A) $A \times H$ (B) $A + H$ (C) $\frac{A}{H}$ (D) $\frac{H}{A}$

xi. The $n^{th}$ term of the series $1.2^2 + 2.3^2 + 3.4^2 + \ldots\ldots$ is $T_n$ = _____. B

(A) $n(n-1)^2$ (B) $n(n+1)^2$ (C) $n^2.(n+1)$ (D) $n^2.(n-1)$ D

xii. How many different words can be formed from the letter "LETTER". _____.

(A) 60 (B) 90 (C) 120 (D) 180

xiii. When a coin is tossed then the probability of getting head is _____. B

(A) $\frac{1}{3}$ (B) $\frac{1}{2}$ (C) $\frac{1}{4}$ (D) $\frac{1}{6}$

xiv. If A and B are mutually exclusive events, then P (A U B) = _____. A

(A) $P(A) + P(B)$ (B) $P(A) - P(B)$

(C) $P(A) + P(B) - P(A \cup B)$ (D) P (A) + P (B) – P (A ∩ B)

xv. The number of terms in the expansion of $(x + 2y)^7$ are_____. C

(A) 6 (B) 7 (C) 8 (D) 9

xvi. If each element of Y is the image of some element in X, then the function f: $x \to y$ is called ____ function. D

(A) Into (B) Bijective (C) Injective (D) Onto

xvii. If $f(-x) = x$, then the function is called an _____ function. [ ]

(A) Odd (B) Identity (C) Even (D) Linear

xviii. $\tan(\frac{\pi}{2} + \theta) =$ _____. B

(A) $\tan\theta$ (B) $-\cot\theta$ (C) $\cot\theta$ (D) $-\tan\theta$

xix. $\cos\frac{\theta}{2} =$ _____. A

(A) $\sqrt{\frac{1+\cos\theta}{2}}$ (B) $\sqrt{\frac{1-\cos\theta}{2}}$ (C) $\sqrt{\frac{1-\sin\theta}{2}}$ (D) $\sqrt{\frac{1+\sin\theta}{2}}$

xx. The range of *Sin x* is _____. D

(B) $[-1,0]$ (B) $[0,1]$ (C) $[-1,2]$ (D) $[-1,1]$

MATHEMATICS (Fresh) - I

**Note: Time allowed for section B and C is 2 hours and 40 minutes.**

## SECTION "B" Marks: 50

**II. Attempt any TEN Parts out of the following. Each Part carries equal marks.**

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

ii. Determine whether $(1+2i)$ is a solution of $Z^2 - 2Z + 5 = 0$

iii. If $A = \begin{bmatrix} 1 & 2 \\ -1 & 3 \end{bmatrix}$, then show that $(A^{-1})^{-1} = A$.

iv. If $A = \begin{bmatrix} 3 & 2 & 1 \\ 4 & 5 & 6 \\ 2 & 3 & 4 \end{bmatrix}$, then show that $(A + A^t)$ is symmetric.

v. Let $\bar{u} = i + 2j - 3k$ and $\bar{v} = zi - j + 2k$, *then find* $\left[\bar{u} - 2\bar{v}\right]$

vi. The first three terms in Arithmetic sequence are 20, 16.5 and 13 respectively. Find the $15^{th}$ term, i.e. $a_{15}$.

vii. For any two number "a" and "b", show that $G^2 = A \times H$.

viii. Find the sum: $1^2 + 3^2 + 5^2 + 7^2 + \ldots\ldots\ldots + 99^2$

ix. Find n, such that ${}^{n^2}C_2 = 30\ {}^{n}C_3$.

x. Let $P(A) = \frac{2}{5}$, $P(B) = \frac{2}{5}$ *and* $P(A \cup B) = \frac{1}{2}$ *then find* $P(A \cap B)$

xi. Show by Mathematical induction that $1^3 + 2^3 + 3^3 + \ldots\ldots + n^3 = \left(\frac{n(n+1)}{2}\right)^3$

xii. Show that $\tan\left(\frac{3\pi}{2} + \theta\right) = -\cot\theta$

xiii. Determine whether the function $f(x) = \left(\frac{x-1}{x+1}\right)$ is even or odd or neither.



## SECTION "C" Marks: 30

**Note: Attempt any THREE questions of the following. Each question carries equal Marks.**

III. (a) Show that $\sin(\alpha+\beta) + \sin(\alpha-\beta) = 2\sin(\alpha) + \cos(\beta)$

(b) Prove that $\left(\sin\frac{\alpha}{2} + \cos\frac{\alpha}{2}\right)^2 = 1 + \sin\alpha$

IV. (a) Solve the triangle ABC, in which $\alpha = 35^0$, $\beta = 70^0$ and C = 115

(b) Find the angle of largest measures, when a=74, b=52, and c=47

V. (a) Find the domain and range of $\sin 2x$.

(b)Draw the graph of the function $y = 2\sin x$, when $0 \le x \le 2\pi$.

VI. (a) Show that $\begin{bmatrix} bc & ca & ab \\ a & b & c \\ a^2 & b^2 & c^2 \end{bmatrix} = \begin{bmatrix} 1 & 1 & 1 \\ a^2 & b^2 & c^2 \\ a^3 & b^3 & c^4 \end{bmatrix}$

(b) If $y = \frac{1}{2^2} + \frac{1\times3}{2!}\cdot\frac{1}{2^4} + \frac{1\times3\times5}{3!}\cdot\frac{1}{2^6} + \ldots\ldots$, then show that $y^2 + 2y - 1 = 0$