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

(Academic Sessions 2019 – 2021 to 2022 – 2024)

MATHEMATICS 223-1st Annual-(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) Show that $\forall z \in C$, $(z-\bar{z})^2$ is a real number.

(ii) Simplify $(a+bi)^{-2}$

(iii) Write the power set of $\{+,-,\times,\div\}$

(iv) Write the converse, inverse of $\sim p \rightarrow q$

(v) Just, convert $(A\cup B)'=A'\cap B'$ and $(A\cap B)'=A'\cup B'$ into logical form.

(vi) 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

(vii) Solve the equations $\begin{aligned}2x_1-3x_2&=5\\ 5x_1+x_2&=4\end{aligned}$

(viii) Define cofactor of an element of matrix.

(ix) Solve the equation $x^3+x^2+x+1=0$

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

(xi) Discuss the nature of roots $2x^2-5x+1=0$

(xii) Give the statement of factor theorem.

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

(i) Without finding constants, write $\dfrac{9x-7}{(x^2+1)(x+3)}$ into partial fraction form.

(ii) If $a_{n-3}=2n-5$, find nth term of A.P.

(iii) Sum the series 3 + 5 – 7 + 9 + 11 – 13 + 15 + 17 – 19 + --- + 3n terms.

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

(v) If 5 is the H.M. between 2 and b, find the value of b.

(vi) Write formula for $\sum_{k=1}^{n} k$ and $\sum_{k=1}^{n} k^3$

(vii) If ${}^{11}P_n = 11.10.9$, then find n

(viii) How many signals can be given by 5 flags of different colours using 3 flags at a time?

(ix) A die is thrown twice. What is the probability that sum of dots shown is either 3 or 11?

(x) Using binomial theorem, expand $\left(3a-\dfrac{x}{3a}\right)^4$

(xi) Find middle term in the expansion of $\left(\dfrac{x}{2}+\dfrac{2}{x^2}\right)^{12}$

(xii) Expand $(1-2x)^{1/3}$ upto first three terms.

(Turn Over)

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

(i) Define angle in the standard position.

(ii) If $\tan\theta = -\frac{1}{3}$ and the terminal arm of angle is in second quadrant then find $\sec\theta$

(iii) Find $\sin\theta$ and $\cos\theta$ for $\theta = \frac{19\pi}{3}$

(iv) If α , β , γ are angles of triangle ABC then prove $\sin(\alpha+\beta) = \sin\gamma$

(v) Without calculator or table, find $\cos(75°)$

(vi) Prove that $\tan(45°+A)\tan(45°-A) = 1$

(vii) Define period of a trigonometric function.

(viii) Solve the right triangle ABC in which $r = 90°$, $a = 3.28$, $b = 5.74$

(ix) By using the law of cosine , write the formula of cosα and cosβ

(x) Solve the triangle ABC if $\beta = 60°$, $\gamma = 15°$ and $b = \sqrt{6}$

(xi) Define the principal sin function.

(xii) Solve the equation $\sin x = \frac{1}{2}$

(xiii) Solve the equation $\sin x + \cos x = 0$ and find its general solution set.

SECTION – II

Note : Attempt any THREE questions.

5. (a) If $A = \begin{bmatrix} i & 1+i \\ 1 & -i \end{bmatrix}$ show that $A - (\overline{A})^t$ is skew-hermitian. 5

(b) When $x^4 + 2x^3 + kx^2 + 3$ is divided by $x - 2$ and remainder is 1, find the value of k. 5

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

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

7. (a) Find ' n ' so that $\frac{a^{n+1}+b^{n+1}}{a^n+b^n}$ may be H.M. between a and b 5

(b) Find $(2n+1)$th term from the end in expansion of $\left(x - \frac{1}{2x}\right)^{3n}$ 5

8. (a) If $\tan\theta = \frac{1}{\sqrt{7}}$ and the terminal arm of the angle is not in the III quad., find the value of $\frac{\operatorname{cosec}^2\theta - \sec^2\theta}{\operatorname{cosec}^2\theta + \sec^2\theta}$ 5

(b) Prove that $\cos 20° \cos 40° \cos 60° \cos 80° = \frac{1}{16}$ 5

9. (a) Solve the triangle ABC if $a = 7$, b = 3 , $\gamma = 38°13'$ 5

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