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

(Academic Sessions 2017 – 2019 to 2020 – 2022)

MATHEMATICS 221-(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) Separate into real and imaginary parts $\frac{2-7i}{4+5i}$

(ii) Prove that for $\forall z \in c \quad z.\bar{z} = |z|^2$

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

(iv) If G be a group and $a, b \in G$, then show that $(ab)^{-1} = b^{-1}a^{-1}$

(v) Give a table for addition of elements of the set of residue classes modulo 5.

(vi) Show that $(p \wedge q) \rightarrow p$ is a tautology.

(vii) Find x and y if $\begin{bmatrix} x+3 & 1 \\ -3 & 3y-4 \end{bmatrix} = \begin{bmatrix} y & 1 \\ -3 & 2x \end{bmatrix}$

(viii) Find the inverse of $\begin{bmatrix} -2 & 3 \\ -4 & 5 \end{bmatrix}$

(ix) Without expansion verify that $\begin{vmatrix} bc & ca & ab \\ \frac{1}{a} & \frac{1}{b} & \frac{1}{c} \\ a & b & c \end{vmatrix} = 0$

(x) Convert $x^{\frac{1}{2}} - x^{\frac{1}{4}} - 6 = 0$ into quadratic equation.

(xi) Evaluate $(-1+\sqrt{-3})^5 + (-1-\sqrt{-3})^5$

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

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

(i) Write $\frac{1}{(1-ax)(1-bx)(1-cx)}$ into partial fraction without finding the values of constants A, B and C.

(ii) Write $\frac{4x^2}{(x^2+1)^2(x-1)}$ into partial fraction without finding the values of unknown constants.

(iii) If $a_{n-3} = 2n - 5$, find nth term of the sequence.

(iv) Find G.M. between $-2i$ and $8i$.

(v) If the numbers $\frac{1}{k}, \frac{1}{2k+1}, \frac{1}{4k-1}$ are in H.P. find the value of k.

(vi) Find A, G and H if $a = 2i$, $b = 4i$

(vii) Find the value of n when ${}^nP_2 = 30$

(viii) Find the number of the diagonals of a 6-sided figure.

(ix) A die is rolled. What is the probability that the dots on the top are greater than 4?

(x) Calculate $(9.98)^4$ by using binomial theorem.

(xi) Expand $(4-3x)^{1/2}$ upto 4 terms by using binomial theorem.

(xii) Evaluate ${}^{12}C_3$

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

(i) Convert $75°6'30''$ into radians.

(ii) Evaluate $\dfrac{1-\tan^2(\frac{\pi}{3})}{1+\tan^2(\frac{\pi}{3})}$

(iii) Prove that $\sec^2 A + \operatorname{cosec}^2(A) = \sec^2(A)\operatorname{cosec}^2(A)$ where $(A \neq \frac{n\pi}{2}, n \in z)$

(iv) Prove that $\tan(180° + \theta) = \tan\theta$

(v) Prove that $\cot(\alpha+\beta) = \dfrac{\cot\alpha\cot\beta - 1}{\cot\alpha + \cot\beta}$

(vi) Prove that $\dfrac{\sin 2\alpha}{1+\cos 2\alpha} = \tan\alpha$

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

(viii) In ΔABC if $\beta = 60°$, $\gamma = 15°$ and $b = \sqrt{6}$ then find 'c'.

(ix) In ΔABC if $a = 34$, $b = 20$ and $c = 42$, find angle ' r '.

(x) Show that $r = (s-a)\tan(\frac{\alpha}{2})$

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

(xii) Find the value of $\sec\left(\sin^{-1}(-\frac{1}{2})\right)$

(xiii) Find the solution of $\operatorname{cosec}\theta = 2$ which lie in $[0, 2\pi]$

SECTION – II

Note : Attempt any THREE questions.

5. (a) Solve the system of equations by Cramer's rule
$$2x + 2y + z = 3$$
$$3x - 2y - 2z = 1$$
$$5x + y - 3z = 2$$ 5

(b) Solve the system of equations $2x - y = 4$; $2x^2 - 4xy - y^2 = 6$ 5

6. (a) Resolve $\dfrac{x-1}{(x-2)(x+1)^3}$ into partial fraction. 5

(b) Find four A.Ms between $\sqrt{2}$ and $\dfrac{12}{\sqrt{2}}$ 5

7. (a) Find the values of n and r when ${}^nC_r = 35$ and ${}^nP_r = 210$ 5

(b) Find the term involving x^4 in the expansion of $(3-2x)^7$ 5

8. (a) Prove that $\dfrac{1+\cos\theta}{1-\cos\theta} = (\operatorname{cosec}\theta + \cot\theta)^2$ 5

(b) Prove that $\dfrac{\cos 3\theta}{\cos\theta} + \dfrac{\sin 3\theta}{\sin\theta} = 4\cos 2\theta$ 5

9. (a) Prove that $(r_1 + r_2)\tan(\frac{\gamma}{2}) = c$ 5

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