QUESTION PAPER FOR HONOURS CANDIDATES FOR EXAMINATION DATED: 05.03.2022

PART – I: **FULL MARKS: CC1 – 10; CC2 – 10**
ONLY FOR MATHEMATICS HONOURS STUDENTS

USE SEPARATE ANSWER SCRIPTS FOR CC-1 AND CC-2 AND UPLOAD SEPARATELY

CC – 1   10

1.   Answer any ONE question: 1×05
(a)   If ρ_1 and ρ_2 be the radii of curvature at the extremities of any chord of the curve
      $r = a(1 + \cos\theta)$, which passes through the pole, then prove that, $\rho_1^2 + \rho_2^2 = \dfrac{16\,a^2}{9}$

(b)   If $U_n = \int_0^1 x^n \tan^{-1}x\, dx$, then prove that $(n + 1)U_n + (n - 1)U_{n-2} = \dfrac{\pi}{2} - \dfrac{1}{n}$

2.   Answer any ONE question: 1×05
(a)   Reduce the equation $x^2 - 5xy + y^2 + 8x - 20y + 15 = 0$ to its canonical form and determine
      the type of the conic represented by it.
(b)   Find the shortest distance between the lines $\dfrac{x-3}{3} = \dfrac{y+1}{4} = \dfrac{z+4}{5}$ and $\dfrac{x-7}{2} = \dfrac{y-4}{3} = \dfrac{z-3}{4}$

CC – 2   10

1.   Find the n-th roots of unity.   03
2.   Define rank of a matrix and find the rank of the matrix   04
$$A = \begin{pmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \\ 7 & 8 & 9 \end{pmatrix}$$

3.   Answer any ONE question: 1×03
(a)   Show that an equivalence relation on a non-empty set define a partition on it and conversely.
(b)   If S is a set containing n elements $(n > 2)$, then show that the set of all odd permutations will
      have $\dfrac{n!}{2}$ elements.

Question for Mathematics Honours ends here.

PART – II: **FULL MARKS: HGE – 10**
ONLY FOR STUDENTS OTHER THAN MATHEMATICS HONOURS
1.   Answer any ONE question: 1×05
(a)   For what value of k the equation $x^2 + 6xy + 9y^2 + kx + 12y - 5 = 0$ represent pair of straight
      line and find the angle between them.
(b)   What does the equation $4x^2 + 2\sqrt{3}xy + 2y^2 = 1$ become when the axes are rotated through an
      angle 30^0?

2.   State and prove the De Moivre's theorem.   03
3.   02
      Find the inverse of the matrix $A = \begin{pmatrix} 1 & 4 & 5 \\ 2 & 6 & 7 \\ 8 & 9 & 3 \end{pmatrix}$.

Question for Other Honours ends here.