STELLA MARIS COLLEGE (AUTONOMOUS), CHENNAI – 600 086
(For candidates admitted during the academic year 2019 – 20 & thereafter)
B.SC. DEGREE EXAMINATION, Dec 2020
BRANCH I – MATHEMATICS

SUBJECT CODE:19MT/MC/DC14

PAPER: Differential Calculus
TIME : 90 minutes **MAX. MARKS: 50**

Section – A

Answer *all* questions **(3 × 2 = 6)**

1. Define envelope of the family of curves.
2. Find the stationary point of the function $xy + \frac{a^2}{x} + \frac{a^2}{y}$.
3. Write any two properties of logarithmic spiral.

Section – B

Answer any *three* questions **(3 × 8 = 24)**

4. Find the n^{th} derivative of $\frac{x^2}{(x+1)^2(x+2)}$.
5. Determine the envelope of the curve $x\cos\alpha + y\sin\alpha = a\cos\alpha\sin\alpha$, where α is the parameter.
6. Find the equation of the circle of curvature at the point (2, 1) on the curve $y = x^2 - 4x + 3$.
7. Find the minimum value of $x^2 + y^2 + z^2$, when $yz + zx + xy = 12$.

Section – C

Answer any *one* question **(1 × 20 = 20)**

8. (a) If $y = \cos(m\sin^{-1}x)$ show that (i) $(1-x^2)y_2 - xy_1 + m^2y = 0$;
   (ii) $(1-x^2)y_{n+2} - (2n+1)xy_{n+1} + (m^2 - n^2)y = 0$.
   (b) Find the evolutes of the curve $x = a\cos\varphi$, $y = b\sin\varphi$ by treating it as the envelope of its normal.

(10+10)

9. (a) Find the radius of curvature of the curve $x = a\cos^3\theta$, $y = a\sin^3\theta$ at $\theta = \pi/4$.
   (b)Classify double points on an algebraic curve $f(x, y)$ and hence determine the existence and nature of the double points on the curve $(x-2)^2 = y(y-1)^2$.

(10+10)

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