STELLA MARIS COLLEGE (AUTONOMOUS) CHENNAI - 600 086
(For candidates admitted during the academic year 2019–20)

SUBJECT CODE : 19MT/MC/DC14

B. Sc. DEGREE EXAMINATION, NOVEMBER 2019
BRANCH I - MATHEMATICS
FIRST SEMESTER

COURSE : MAJOR – CORE
PAPER : DIFFERENTIAL CALCULUS
TIME : 3 HOURS **MAX. MARKS : 100**

SECTION – A (10X2=20)

ANSWER ANY TEN QUESTIONS

1. Find the n^{th} derivative of $(ax+b)^m$.
2. State the Leibnitz's theorem for n^{th} derivative of product of two function.
3. Define curvature.
4. Write the formula for radius of curvature in parametric form.
5. Define envelope of the curve.
6. Find the envelope of the straight line $y = mx + a/m$, m being the parameter.
7. State the conditions to determine the maximum and minimum of extrema with two variables.
8. Write the necessary conditions for maximum and minimum of extrema with two variables.
9. Write both the equation of cardioids.
10. Write the equation of evolute of the ellipse $x^2/a^2 + y^2/b^2 = 1$.
11. Define double point.
12. Find the n^{th} derivative of $sin(ax+b)$.

SECTION – B (5X8=40)

ANSWER ANY FIVE QUESTIONS

13. If $y = 2\,cos\,x(sin\,x - cos\,x)$ show that $(y_{10})_0 = 2^{10}$.
14. If $x = a(\theta + sin\,\theta)$ and $y = a(1 - cos\,\theta)$ find the radius of curvature at $\theta = 0$.
15. Examine the extreme value of the function $x^2 + y^2 + (x+y+1)^2$.
16. Find the envelope of the straight line $x/a + y/b = 1$ where a and b are the parameters connected by the relation $a + b = c$.
17. Write the equation of catenary and its properties
18. If $y = e^{cos^{-1}x}$ then prove that $(1-x^2)y'' - xy' = y$.
19. Find the envelope of the family of straight line $A\alpha^2 + B\alpha + C = 0$ where α is the variable parameter and $A.B$ and C are linear functions of x and y.

SECTION – C **(2X20=40)**

ANSWER ANY TWO QUESTIONS

20. a) If $y = cos\ (m\ sin^{-1}\ x)$ then prove that

(i) $(1 - x^2)y_2 - \ xy_1 + m^2y \ = \ 0.$

(ii) $(1 - x^2)y_n + 2 - \ (2n + 1)xy_{n+1} - (m^2 - n^2)\ y_n = \ 0.$

b) Find evolutes of the parabola $y^2 = 4ax.$

21. a) Find the maximum value of $x^2y^2z^4$ subject to the condition $x + y + z \ = 18$ by Lagrange multiplier method.

b) Find the envelope of the straight line $x/a \ + y/b \ = \ 1$ where a and b are the parameters connected by the relation $a^2 + b^2 = c^2$.

22. a) Write the equation of logarithmic spiral and its properties

b) Find all the maxima and minima of the function $4x^2 - \ xy \ + \ 4y^2 + \ x^3y \ + xy^3 - 4$