

STELLA MARIS COLLEGE (AUTONOMOUS) CHENNAI - 600 086
(For candidates admitted during the academic year 2015–16)

SUBJECT CODE : 15MT/MC/DC14

B. Sc. DEGREE EXAMINATION, NOVEMBER 2015
BRANCH I - MATHEMATICS
FIRST SEMESTER

COURSE : MAJOR – CORE
PAPER : DIFFERENTIAL CALCULUS
TIME : 3 HOURS

MAX. MARKS : 100

SECTION – A
ANSWER ALL THE QUESTIONS

(10X2=20)

1. Find the nth derivative of $\sin(ax + b)$.
2. If $y = a\cos(\log x) + b\sin(\log x)$, Prove that $x^2y_2 + xy_1 + y = 0$.
3. Define Envelope of the family of curves C .
4. State the equation of the envelope when, $f(x, y, t) = 0$ is a quadratic in t .
5. Write the Cartesian formula for the radius of curvature.
6. Find the co-ordinates of the centre of curvature of the curve $y = x^2$ at the point $(1/2, 1/4)$.
7. Write the pedal equation of a curve.
8. Derive chord of curvature parallel to x -axis.
9. Define maxima and minima of functions of two variables.
10. When do you say a curve is symmetrical about the x axis? Give example.

SECTION – B
ANSWER ANY FIVE QUESTIONS

(5X8=40)

11. Find the nth derivative of $e^{3x} \sin x \sin 2x \sin 3x$.
12. If $y = x^2 e^x$, show that $y_n = \frac{1}{2} n(n-1) y_2 - n(n-2) y_1 + \frac{1}{2} (n-1)(n-2)y$.
13. Find the envelope of the family of straight lines $tx = 2at + at^3$, the parameter being t .
14. Show that the radius of curvature at any point of the catenary $y = c \cosh \frac{x}{c}$ is equal to the length of the portion of the normal intercepted between the curve and the axis of x .
15. Find ρ at the point ' t ' of the curve $x = a(\cos t + t \sin t)$, $y = a(\sin t - t \cos t)$.
16. Prove that $(p - r)$ equation of the cardioid $r = a(1 - \cos \theta)$ is $p^2 = \frac{r^3}{2a}$.
17. Find the maximum or minimum values of $2(x^2 - y^2) - x^4 + y^4$.

SECTION – C
ANSWER ANY TWO QUESTIONS

(2X20=40)

18. (a) If $y^{1/m} + y^{-1/m} = 2x$, prove that
 $(x^2 - 1)y_{n+2} + (2n + 1)xy_{n+1} + (n^2 - m^2)y_n = 0$.
- (b) If $y = [\log(x + \sqrt{1 + x^2})]^2$, show that
 $(1 + x^2)y_{n+2} + (2n + 1)xy_{n+1} + n^2y_n = 0$.
- (c) Find the envelope of the family of curves $\frac{x^2}{a^2} + \frac{y^2}{k^2 - a^2} = 1$, where a is a parameter.
(7+7+6)
19. (a) Prove that the radius of curvature at any point of the cycloid $x = a(\theta + \sin \theta)$ and
 $y = a(1 - \cos \theta)$ is $4a \cos \frac{\theta}{2}$.
- (b) Show that the evaluate of the cycloid $x = a(\theta - \sin \theta)$ and $y = a(1 - \cos \theta)$ is
another Cycloid.
(10+10)
20. (a) Find the extreme values of the function $f(x, y) = x^2 + y$ on the circle $x^2 + y^2 = 1$.
- (b) Trace the curve $y = (x - 1)(x - 2)(x - 3)$.
(10+10)

