STELLA MARIS COLLEGE (AUTONOMOUS) CHENNAI - 600 086
(For candidates admitted during the academic year 2011–12 & thereafter)

SUBJECT CODE: 11MT/MC/OD34

B. Sc. DEGREE EXAMINATION, NOVEMBER 2014
BRANCH I - MATHEMATICS
THIRD SEMESTER

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

SECTION-A
Answer All the questions **(10 x 2 = 20)**

1. Solve $y = px + \frac{ap}{(1+p^2)^{1/2}}$.
2. Solve $a(xdy + 2ydx) = xydy$.
3. Solve $p^2 - 5p + 6 = 0$.
4. Find the complimentary function of $(D^2 - 4D - 5)y = e^{3x}$.
5. Find the particular integral of $(D^2 + 4)y = xe^{2x}$.
6. Define orthogonal trajectory.
7. Write the differential equation of Glucose Tolerance test.
8. Write the differential equation of motion of a falling body without any resistance.
9. State the condition for overdamped and underdamped of a series circuit.
10. Write the differential equation of a motion of a rocket when the fuel is burnt off.

SECTION-B
Answer any FIVE questions **(5 x 8 = 40)**

11. Find the orthogonal trajectories of the cardioids $r = a(1 + \cos\theta)$, a being the parameter.
12. Solve $\sqrt{1+p^2}\, x + p = a\sqrt{1+p^2}$.
13. Solve $(D^2 - 2D + 4)y = e^x \cos x$.
14. Solve $x^2 \frac{d^2y}{dx^2} + x \frac{dy}{dx} - 3y = x^2$e.
15. Solve $\frac{dx}{x(y-z)} = \frac{dy}{y(z-x)} = \frac{dz}{z(x-y)}$.
16. Suppose a cannon ball weighing 16 pounds is shot vertically upwards with an initial velocity $v_0 = 300$ ft/s. Find a) the velocity at any time t. b) the maximum height attained by the cannon ball. (ignore air resistance)
17. Explain the model for coupled strings and obtain the solution.

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SECTION-C
Answer any TWO questions **(2 x 20 = 40)**

18. a) Solve $(y - 3x^2)dx - x(1 - xy^2)dy = 0$.

b) Solve $\frac{d^2y}{dx^2} + y = \sec x.$ (10+10)

19. a) Solve $\frac{dx}{dt} - y = t,\ \frac{dy}{dt} + x = t^2.$

b) Solve $zy\,dx = zx\,dy + y^2\,dz$ (10+10)

20. a) Find the charge on the capacitor in an LRC series circuit at $t = .01$ when $L = .05$ henry, $R = 2\Omega$, $C = .01F$, $E(t) = 0V$, $q(0) = 5$. Coulomb and $i(0) = 0$. Determine the first time at which the charge on the capacitor is equal to zero.

b) Explain the model for coupled springs and obtain the solution.