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

SUBJECT CODE :11MT/PE/FD44

M. Sc. DEGREE EXAMINATION, APRIL 2016
BRANCH I – MATHEMATICS
FOURTH SEMESTER

COURSE : ELECTIVE
PAPER : FLUID DYNAMICS
TIME : 3 HOURS **MAX. MARKS : 100**

SECTION – A

ANSWER ALLQUESTIONS : (5 X 2 = 10)

1. Define acceleration of a fluid.
2. State Kelvin's theorem.
3. Define simple source.
4. State Blasius theorem.
5. What is laminar flow?

SECTION – B

ANSWER ANY FIVEQUESTIONS : (5 X 6 = 30)

6. At the point in an incompressible fluid having spherical polar coordinates, the velocity components are $(2Mr^{-3}\cos\theta,\ Mr^{-3}\sin\theta,\ 0)$ where M is a constant. Show that the velocity is of the potential kind. Find also the velocity potential.

7. Derive Euler's equation of motion.

8. Prove that for irrotational incompressible two-dimensional flow, stream function and velocity potential are harmonic functions.

9. Discuss the flow due to a uniform line doublet at O of strength μ per unit length, its axis being along $\overline{OX}$.

10. Discuss the steady viscous flow in tubes of uniform cross section.

11. Discuss the flow for which $w = z^2$.

12. Using the theorem of Blasiusdisucss the motion in an infinite circular cylinder in uniform stream with circulation.

..2

SECTION – C

ANSWER ANY THREEQUESTIONS : (3 X 20 = 60)

13. Drive the equation of continuity. Hence derive the equation of continuity for
(i) steady flow (ii) incompressible fluid (iii) flow of potential kind.

14. Prove Kelvin's theorem and write the results that stem from Kelvin's theorem.

15. a) State and prove Milne-Thomson's circle theorem.
b) Obtain the complete velocity potential for a line doublet parallel to the axis of a right circular cylinder.

16. Derive the Navier-Stoke's equation of motion of a viscous fluid.

17. a) Define (i) doublet (ii) strength of the doublet
(iii) vector moment of doublet (iv) axis of the doublet
b) Discuss doublet in a uniform stream.