

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

SUBJECT CODE : 15MT/PC/FD34

M. Sc. DEGREE EXAMINATION, NOVEMBER 2016
BRANCH I - MATHEMATICS
THIRD SEMESTER

COURSE : CORE
PAPER : FLUID DYNAMICS
TIME : 3 HOURS

MAX. MARKS : 100

SECTION – A

ANSWER ALL THE QUESTIONS:

(5 x 2 = 10)

1. Define path lines.
2. What are the conditions satisfied at the boundary of two inviscid immiscible fluids?
3. Define a dipole.
4. Define line source and line sink.
5. Define stress matrix.

SECTION – B

ANSWER ANY FIVE QUESTIONS:

(5 x 6 = 30)

6. Discuss the acceleration of a fluid.
7. Show that at all points in the field of flow the equipotential are cut orthogonally by the stream lines.
8. Derive Bernoulli's equation.
9. a. Show that in two dimensional flow the vorticity vector is perpendicular to the plane of flow.
b. Discuss the flow due a uniform line doublet at O of strength μ per unit length, its axis being along \overline{OX} .
10. Discuss the uniform flow past a fixed infinite circular cylinder.
11. Obtain the image of a line source in a circular cylinder.
12. Discuss the stress analysis in fluid motion.

SECTION – C

ANSWER ANY THREE QUESTIONS:

(3 x 20 = 60)

13. a. Derive equation of continuity.
b. For a fluid moving in a fine tube of variable section A , prove from first principles that the equation of continuity is $A v = \text{constant}$ where v is the speed at a point P of the fluid and s the length of the tube up to P . What does this become for steady incompressible flow?
14. a. Derive Euler's equation of motion.
b. Discuss the steady motion under conservative body forces.
15. Define Stoke's stream function $\psi(r, \theta)$ for the symmetric flow of an incompressible fluid. Also determine the stream function corresponding to a uniform stream U .
16. a. State and prove Milne Thompson Circle theorem.
b. Determine the irrotational motion of a incompressible liquid for which the complex potential $\omega = ik \log z$.
17. Discuss steady motion between parallel planes.

