NOVEMBER/DECEMBER 2018

MMA35C — FLUID DYNAMICS

Time : Three hours Maximum : 75 marks

SECTION A — (5 × 6 = 30 marks)

Answer ALL questions.

1. (a) Show that the acceleration of a fluid of $f = \frac{\partial q}{\partial t} + \nabla\left(\frac{1}{2}q^2\right) - q \wedge (\nabla \wedge q)$.

Or

(b) Obtain the velocity potential.

2. (a) Derive Bernoulli's equation of a fluid.

Or

(b) Obtain the conditions at a boundary of two inviscid immiscible fluids.

3. (a) Write a short notes on doublet.

Or

(b) Obtain the physical meaning of Stoke's stream function.

4. (a) Explain the meaning of two dimensional flow.

Or

(b) Discuss the flow for which $W = Z^2$.

5. (a) Obtain the relations between the Cartesian components of stress.

Or

(b) Discuss the stress analysis in fluid motion.

SECTION B — ($3 \times 15 = 45$ marks)

Answer any THREE questions.

6. Test whether the motion specified by $q = \frac{K^2(xj - yi)}{(x^2 + y^2)}$ (K is a constant) is possible motion for an incompressible fluid. If so, determine equation of the stream lines. Also test whether the motion is of the potential kind and if so determine the velocity potential.

7. Discuss the Venturi tube problem.

8. Doublets of strengths μ_1, μ_2 are situated at points A_1, A_2 whose Cartesian coordinates are $(0,0,c_1)$, $(0,0,c_2)$, their axes being directed towards and away from the origin respectively. Find the condition that there is no transport of fluid over the surface of the sphere $x^2 + y^2 + z^2 = c_1 c_2$.

9. Find the equations of the streamlines due to uniform line sources of strength m through the points $A(-c,0)$, $B(c,0)$ and a uniform line sink of strength 2 m through the origin.

10. State and prove the Navier Stokes equations of motion of a viscous fluid.