AE-810

M.A./M.Sc. (Final)
Term End Examination, 2016-17

MATHEMATICS

Optional

Paper - VI

Fluid Mechanics

Time : Three Hours] [*Maximum Marks* : 100
[*Minimum Pass Marks* : 36

Note : Answer any **five** questions. All questions carry equal marks.

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1. Describe the Lagrangian and Eulerian methods for studying the general problems of fluid dynamics.

2. Describe streamline, path lines and streak lines.

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3. What is Velocity Potential ? Prove that at all points of the field of flow the equipotentials (i.e. equipotential surfaces) are cut orthogonally by the streamlines.

4. Prove that the necessary and sufficient condition such that the vortex lines are at right angles to the streamlines, is

$$(u,\ v,\ w) = \mu\left(\frac{\partial\phi}{\partial x}, \frac{\partial\phi}{\partial y}, \frac{\partial\phi}{\partial z}\right)$$

i.e. $\bar{q} = \mu\nabla\phi$, where μ and ϕ are functions of x, y, z and t.

5. Find the equation of continuity

$$\frac{\partial\rho}{\partial t} + \nabla.(\rho\bar{q}) = 0$$

6. Obtain Euler's equation of motion by flux method.

7. Write short notes on the following :

(*a*) Lagrange's stream function

(*b*) Sources, sinks and doublets

8. Describe two-dimensional irrotational motion produced by motion of circular cylinder in an infinite mass of liquid at rest at infinity.

9. State and prove Blasius theorem.

10. Write short notes on any **two** of the following :

(*a*) Speed of Sound

(*b*) Equation of motion of a gas

(*c*) Normal and oblique shocks

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