



## UTTARAKHAND OPEN UNIVERSITY, HALDWANI (NAINITAL)

उत्तराखण्ड मुक्त विश्वविद्यालय, हल्द्वानी (नैनीताल)

**M.Sc. Mathematics**  
**ASSIGNMENT-SECOND YEAR**

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*Last Date of Submission:* 15 May 2015जमा करने की अन्तिम तिथि: 15 May 2015

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**Course Title: Viscous Fluid Dynamics****Course Code: MAT 507****Year: 2014-15****Maximum Marks : 40****Section 'A'****भाग क**

**Section 'A' contains 08 short answer type questions of 5 marks each. Learners are required to answers 4 questions only.**

1. State and prove stress invariant in two dimensions.
2. Find equation of continuity in vector form.
3. State and prove Buckingham  $\pi$ - theorem.
4. Obtain velocity profile for plane Couette flow.
5. Write down the energy equation in plane Couette flow with transpiration cooling.
6. What are the Stoke's equation for slow motion ?
7. Explain Drag and lift.
8. Determine the displacement thickness and momentum thickness for the laminar boundary layer on a flat plate for which the velocity distribution in given by the relation

$$\frac{u}{U} = 2 \left( \frac{y}{\delta} \right) - 2 \left( \frac{y}{\delta} \right)^3 + 2 \left( \frac{y}{\delta} \right)^4$$

**Section 'B'**

- **Section 'B' contains 04 long answer-type questions of 10 marks each. Learners are required to answers 02 questions only.**

1. Define stress at a point. Find principle stress and principle directions at a point for which stress tensor is given by

$$\begin{bmatrix} 11 & 2 & 8 \\ 2 & 2 & -10 \\ 8 & -10 & 5 \end{bmatrix}$$

2. Define the principle of energy conservation Derive energy equation for a compressible fluid and deduce it for incompressible fluid.
3. Derive Blasius equation for laminar boundary layer flow of an incompressible viscous fluid along a flat plate. Discuss velocity distribution in the boundary layer.
4. Discuss the flow due to a plane wall suddenly set in motion in its own plane in an infinite mass of viscous incompressible fluid. Which is otherwise at rest?