

**STELLA MARIS COLLEGE (AUTONOMOUS) CHENNAI-86.**  
**(for candidates admitted during the academic year 20011 – 12)**  
**M.Phil. DEGREE EXAMINATION - April 2013**  
**Mathematics**  
**Second Semester**

**Subject Code:11MT/RO/FD2 05**  
**Max Marks: 100**  
**Time : 3 Hours**

**Course : Optional**  
**Paper : Fluid Dynamics**

**Answer any five questions**

- 1 a) Derive Navier Stokes equations of motion of a viscous fluid .  
b) Discuss the steady flow through a circular pipe.
2. Discuss the boundary conditions of the fluid at the layer at a free surface. Obtain the components of the velocity vector field in a rotating field. Define the Ekman layer.
3. Write a note on the following:  
i) Boundary layer thickness ii) Displacement thickness iii) Viscous drag  
iv) Estimation of frictional forces and skin friction coefficient  
v) Momentum thickness vi) Energy thickness.
4. When do you set a boundary layer flow . Derive Prandtl's boundary layer equations.
5. Explain the concept of separation of the boundary layer. Define the separation point and prove that the position of the separation point is independent of the Reynold's number.
6. Discuss Stokes First problem
7. a) Obtain Brinkmen's equation to discuss the flow through porous medium.  
b) Explain heat transfer through a porous medium and obtain the energy equation.
8. Derive the laminar flow of a viscous conducting liquid between parallel walls in a transverse magnetic field.

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