Biyani's Group of Colleges

M.Sc. (P) Mathematics
Paper-II , set A
Viscous Fluid Dynamics

Time: 2:30 **Maximum Marks: 100**

Unit I

1. (a) define the stress at a point in a fluid and show that it is a symmetric second order Cartesian tensor.

   (b) Derive equation of continuity for an incompressible viscous fluid.

2. (a) Define circulation and deduce Kelvin's circulation theorem.

   (b) Write short notes on

   (i) March number (ii) Nusselt Number

Unit II

3. (a) Discuss the velocity distribution for generalized plane coquette flow and various cases arising due to different nature of non-dimensional pressure gradient in this motion.

   (b) derive velocity distribution for the plane poiseuille flow between two parallel plates.

4. (a) Discuss about the steady flow of a viscous incompressible fluid through a tube of arbitrary but uniform, cross-section.

   (b) Derive the velocity distribution in the annular region between concentric cylinders of radii a and b(a>b).

Unit-III

5. (a) Discuss Hiemenz flow of a viscous incompressible fluid in the neighbourhood of a Stagnation point.

   (b) Discuss the velocity distribution in stokes Second problem of due to an oscillating plane wall.

6. Derive and discuss velocity distribution near a rotating disc in a fluid otherwise at rest. Also derive moment coefficient on wall.

Unit-IV

7. Derive temperature distribution and Nusselt number in Hagen-Poiseuille flow when wall of the pipe is kept at a constant temperature.

8. Derive velocity and temperature distribution in plane coquette flow with transpiration cooling.

Unit -V

9. Derive two dimensional thermal boundary layer equation for flow over a plane wall.

10 Derive velocity components and drag coefficient in Oseen's flow past a sphere.