Biyani's Group of Colleges θ

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

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

Unit I

1. (a) Show that the most general motion of a fluid element consists of a translation , a rotation and a deformation.

   (b) define fourier's law of heat conduction and derive equation of energy.

2. (a)State and prove Buckingham π- theorem in dimensional analysis.

   (b) Write short notes on

   (i) Reynolds number (ii) Prandtl number

Unit II

3. (a) Derive and discuss velocity distribution in

   (i) Plane coquette flow (ii) Plane Poiseuille flow

   (b) derive.

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 and volume rat flow in a tube of rectangular cross- section.

Unit-III

5..(a) obtain an expression in the form $\emptyset''' + 2\emptyset\emptyset'' - \emptyset'^2 + 1 = 0$ which leads to the Solution for the velocity components for the flow near a stagnation in an axially symmetrical case.

(b) Discuss flow due to a plane wall suddenly set in motion.

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 poiseuilli 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 flow over a plane wall using order of magnitude approach.

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