M.Sc. SEM-III VISCOUS FLUID DYNAMICS

Part - A

Q.1 Define skin-friction coefficient.

Q.2 Obtain an expression for the velocity distribution in the plane poiseuille flow.

Q.3 Give the physical significance of the eq^n of continuity.

Q.4 In the generalized plane couette flow what happens when the dimensionless pressure gradient P is negative?

Q.5 Write the simplified Navier-Stokes equations along with the boundary conditions for the flow in a circular pipe.

Q.6 What is equation of state?

Q.7 What is plane poiseuille flow?

Q.8 Write polar form of Navier-Stokes equation?

Q.9 Write velocity components in terms of angular velocity in case of Karman flow.

Q.10 What type of flow is called Hiemenz flow?

Q.11 Define Reynold's law of similarity.

Q.12 State Newton's Law of viscosity.

Q.13 Define circulation.

Q.14 Define laminar flow.

Q.15 Write down the boundary conditions in Hagen-Poiseuille flow.

Q.16 Obtain a general expression for the velocity distribution of the flow between two large plates.

Q.17 Define drag coefficient.

Q.18 State Buckingham π-theorem.

Q.19 Define stagnation point and thermal conductivity.

Q.20 Define Eckert number.

Part - B

Q.1 Derive the Navier - Stoke's eqn of motion governing the flow of viscous incompressible fluid in cartesian tensor notation.

Q.2 Discuss the steady flow of a viscous incompressi fluid through a tube of uniform equilateral triangular cross section.

Q.3 Derive and discuss the velocity distribution for the generalized plane couette flow between two parallel plates and calculate the volume rate of flow.

Q.4 Discuss rotationally symmetrical flow with stagnation point and show that the eqn of motion in non - dimensional form is given by $\phi''' + 2\phi\phi'' - \phi'^2 + 1 = 0$

Q.5 Establish the formula $\frac{\pi a^4}{8\mu L}(p_1 - p_2)$ for the volume rate of flow.

Q.6 Derive the eqn of Continuity with the help of cartesian tensor notation.

Q.7 Derive velocity distribution for the plane Poiseuille flow between two parallel plates.

Q.8 Derive the expression of velocity distribution of a viscous incompressible fluid flow through rectangular cross section.

Q.9 Discuss the steady flow of a viscous in compressible fluid through a channel of annular cross section.

Q.10 Derive volume rate of flow of a viscous incompressible fluid in tube of equilateral triangular cross-section.

Q.11 Find out the complete set of non-dimensional parameters, using π-Theorem for the flow of a viscous compressible fluid.

Q.12 Define strain and obtain the rates of strain components in the general three dimensional cartesian coordinate system.

Q.13 Discuss steady flow of a viscous incompressible fluid through a tube of uniform equilateral triangular cross section.

Q.14 Define the following non-dimensional parameters.

1. Reynold's number
2. Brinkman number
3. Eckert number
4. Nusselt number.

Q.15 Discuss the flow between two cocentric cylinders of radius r_1 and r_2 ($r_1 < r_2$) rotating with angular velocities ω_1 and ω_2 respectively. If the inner cylinder is at rest, prove that in the steady motion the velocity distribution is given by:-

$$V_\theta = \frac{\omega_2^2 r_2^2}{(r_2^2 - r_1^2)} \left(r - \frac{r_1^2}{r} \right)$$

Q.16 Prove that stress at a point in a fluid is a symmetric second order tensor.

Q.17 Discuss the homann flow for a viscous incompressible fluid with stagnation point.

Q.18 Write a note on the stoke's law of friction.

Q.19 Deduce Kelvin's circulation theorem.

Q.20 Derive the constitutive eq^n for an isotropic Newtonian fluid.