(b) An oil of viscosity 0.1 Ns/m^2 and relative density 0.9 is flowing through a circular pipe of diameter 50 mm and of length 300 m. The rate of flow of fluid through the pipe is 3.5 lit/sec. Find the pressure dorp in a length of 300 m and also the shear stress at the pipe wall.

4. (a) Determine the maximum velocity, shear velocity, average velocity and discharge in a pipe of 150 mm diameter, 100 m long and loss of pressure over this length is 26.6 kN/m^2. Take pipe as smooth and viscosity 10^{-6} m^2/s. take f =0.013 **8**

(b) A lubricating oil of viscosity 1 poise and sp. gravity 0.9 is pumped through a 25 mm diameter pipe. If the pressure drop per meter length of pipe is 20 kN/ m^2, determine:- **12**

(i) Mass flow rate in kg/min
(ii) Shear stress at pipe wall
(iii) Reynolds number of flow
(iv) Power required per 50 m length of the pipe to maintain the flow

5. (a) Derive an expression for area velocity relationship for a compressible fluid in the form, $\frac{dA}{A} = \frac{dV}{V}\left[M^2 - 1\right]$ **10**

(b) An aeroplane is flying at 1000 km per hour through still air having a pressure of 78.5 kN/m^2 (abs) and temp. - 8°C. Calculate on the stagnation point on the nose of the plane stagnation pressure, stagnation temperature and stagnation density. Take for air R =287 J/kg K and γ = 1.4. **10**

6. (a) Calculate discharge in each pipe of network as shown in fig.The pipe network consists of 5 pipes. The head loss h_f in the pipe is given by $h_f = kQ^2$.The values of k for various pipes and also inflow or outflows at nodes are as shown in fig. **10**