Solution to Problem 149A:

Using the solution for Poiseuille flow, the average velocity in the pipe, $\overline{u}$, is

$$\overline{u} \;=\; \frac{R^2}{8\mu}\left(-\frac{dp}{dx}\right) \;=\; \frac{(0.25\times 10^{-6}\ m^2)(0.15\times 10^5\ kg/m\ s^2)}{8(10^{-3}\ kg/m\ s)(1.0\ m)} \;=\; 0.47\ m/s \tag{1}$$

Therefore the Reynolds number of the flow in the pipe is

$$Re \;=\; \frac{2R\rho\overline{u}}{\mu} \;=\; \frac{(1000\ kg/m^3)(0.47\ m/s)(0.001\ m)}{(10^{-3}\ kg/m)\ s)} \;=\; 470 \tag{2}$$

and therefore the friction factor, f, for this flow which is laminar at this Reynolds number is

$$f \;=\; \frac{64}{Re} \;=\; \frac{64}{470} \;=\; 0.136 \tag{3}$$