(   )

1. Laminar flow in a horizontal pipe of diameter D gives a flowrate of Q if the pressure gradient is $\partial p / \partial x = -K$. The fluid is cooled so that the density increases by a factor of 1.04 and the dynamic viscosity increases by a factor of 3.8. Determine the new pressure gradient required (in terms of K) if the flowrate remains the same. (20%)

2. An open rectangular container contains a liquid that has a specific weight that varies according to the equation $=c_1+c_2 \times h$, where c_1 and c_2 are constants and h is a vertical coordinate measured downward from free surface. Derive an equation for the magnitude of the liquid force exerted on one wall of the container having a width, B, and height, H. (20%)

3. Fig.1 shows a submerged flow over a sharp-crested weir in a rectangular channel. If the discharge per unit width is 3.5 m^3/s/m, estimate the energy loss due to the weir. What is the force on the weir plate? (20%)

1.80 m

1.30 m

0.80 m
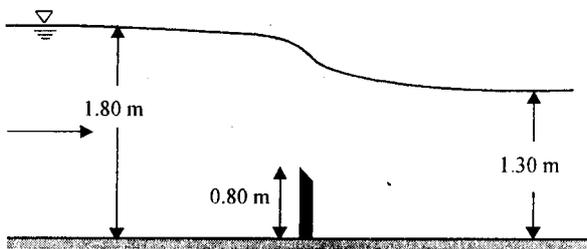
Fig. 1

4. A 4 m long curved gate is located in the side of a reservoir containing water as shown in Fig.2 Determine the magnitude of the horizontal and vertical components of the force of the water on the gate. $\gamma = 9.8KN/m^2$. (20%)

Water

9 m

A

3 m

Gate
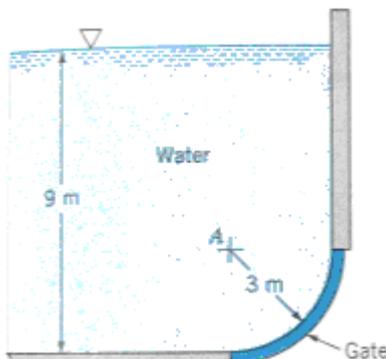
Fig.2

5. The x and y component of a velocity field are given by u $=x^2y$ and v= $-xy^2$. Determine the equation for the streamlines of this flow. (20%)