

## OPEN CHANNEL FLOW

1. Classify each of the following flows as steady or unsteady from the viewpoint of the observer:

<i>Flow</i>	<i>Observer</i>
(a) Flow of river around bridge piers	(1) Standing on bridge (2) In boat, drifting
(b) Movement of flood surge downstream	(1) Standing on bank (2) Moving with surge

***Solution.***

(a) Over relatively short time intervals, the observer standing on the bridge will see a steady flow even though the flow may be unsteady over longer time intervals; however, the observer drifting in the boat will see an unsteady flow as the boat passes under the bridge because the velocity increases around the bridge piers even if the approach flow is steady.

(b) An observer standing on the river bank will see an unsteady flow as the surge passes but a steady flow while riding on the surge if the flow is uniform in the direction of movement.

2. At the crest of an ogee spillway as shown in Figure 1.1c, would you expect the pressure on the face of the spillway to be greater than, less than, or equal to the hydrostatic value? Explain your answer.

***Solution.***

The convex curvature near the crest of the spillway results in a centripetal acceleration toward the center of curvature and a corresponding pressure gradient with decreasing pressure toward the center of curvature. The decreasing pressure reduces the equivalent hydrostatic pressure for a parallel flow so that the pressure is less than hydrostatic on the face of the spillway. The decrease in pressure can be so severe that vapor pressure is reached and cavitation occurs with pitting and erosion of the concrete spillway surface (see Chapter 6).