

## CIVL 4046 Fluid Mechanics

### Mid-Term Examination

Total marks: 100

Time allowed: 90 minutes

Use of class notes and textbook is allowed. Attempt all the questions.

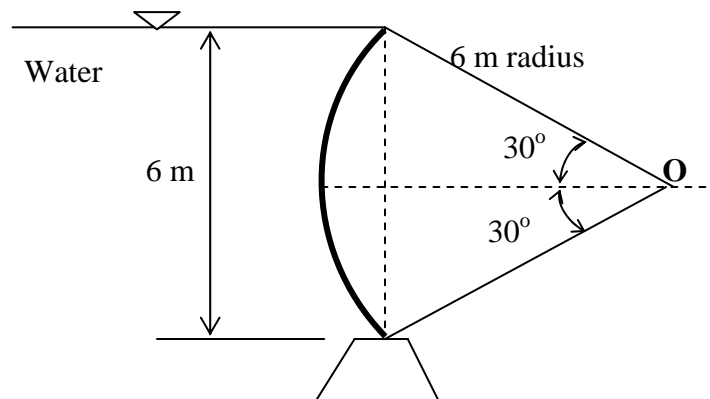
1. A steel pipeline conveying gas has an internal diameter of 120 cm and an external diameter of 125 cm. It is laid across the ocean, completely immersed in water and is anchored at intervals of 3 m along its length. Calculate:

(a) The buoyancy force in Newton/meter [15]

(b) Upward force in Newtons on each anchorage. [15]

Density of steel =  $7900 \text{ kg/m}^3$ , density of sea water =  $1025 \text{ kg/m}^3$ .

2. A sluice gate is in the form of a circular arc of radius 6m as shown below. Calculate the magnitude and direction of the resultant force on the gate, and the location with respect to O of a point on its line of action. [50]



3. A piston has a diameter of 50 mm and moves in a cylinder of 51 mm internal diameter. The cylinder is closed and contains water. If the piston is forced into the cylinder at 20m/s, what will be the velocity at which the water escapes between the piston and the cylinder wall? [20]