

Birzeit University – Faculty of Engineering  
Mechanical Engineering Department  
Fluid Mechanics ME 335  
First Exam

Instructor: Dr. Afif Hasan

2<sup>nd</sup> semester 2011/2012

Note: Specific weight of water  $9790 \text{ N/m}^3 = 62.4 \text{ lb}_f/\text{ft}^3$

**Problem 1 (15%)**

The hydraulic jack in figure 1 is filled with oil ( $s.g. = 0.90$ ). Neglecting pistons weight, what force  $F$  required on handle to support  $2000 \text{ lb}_f$  weight shown.

**Problem 2 (55%)**

Water depth behind a dam is  $6 \text{ m}$ ; at the base of the dam there is  $2 \text{ m}$  by  $3 \text{ m}$  exit tunnel as shown in figure 2. At end of a tunnel a quarter circle gate is hinged at the center (pivot point) of the cylinder  $O$ .

- Calculate the horizontal force and its location on the gate [15]
- Calculate the vertical component on the gate [15]
- Determine the magnitude, direction and location of the resultant force on the gate (an angel and appoint that forces passes through). [10]
- What is the moment of resultant force about the pivot point. [5]
- What is the magnitude of the vertical force  $F$  to prevent gate from rotating, neglecting weight of gate? [10]

**Problem 3 (30%)**

A solid cylinder is  $3 \text{ ft}$  in diameter,  $6 \text{ ft}$  high and weighs  $1550 \text{ lb}_f$ . The cylinder is placed in oil ( $s.g. = 0.90$ ) with its vertical axis as shown in figure 3.

- What is the submerged depth of cylinder? [10]
- Would the cylinder be stable? Explain why? [20]

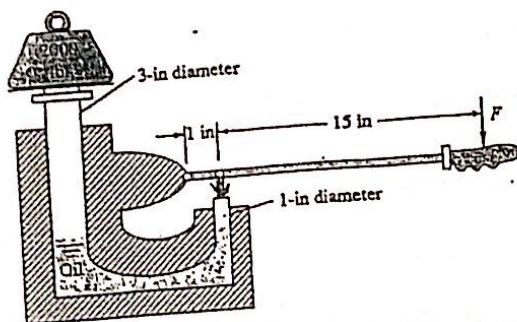


Figure 1

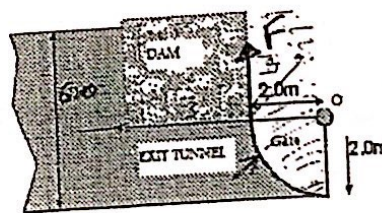


Figure 2

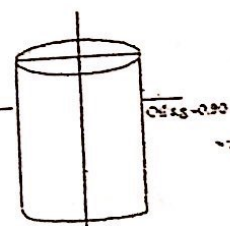


Figure 3