Academic Affairs Assessment of Student Learning
Report for Academic Year _2023-2024_

Department/Program __Engineering/Civil (BS) and Engineering/Chemical (BS)__
Assessment Coordinator's Name: Mohammad T Bhuiyan
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1. **Which learning outcomes did you measure this past year?** [Please indicate whether any of these measures were conducted as follow-up to a previous year's issues or in response to Program Review. Be specific.]

   Program Student Outcomes (SO) 1 to 7 were measured in AY 2023-24.

   Program Educational Objectives (PEO) 1 to 3 were measured in AY 2023-24.

2. **In which course(s) were assessments conducted?**

   ENGR 301 in Spring 2024.

   ENGR 479 and ENGR 101 in Fall 2023.

3. **How did you assess the selected program learning outcomes?** (i.e., what did you assess – group project, skills demonstration, presentation, performance, debate, lab experiment, online discussion, etc. *and*- what tool (measure) did you use - rubric, nationally or state-normed exam, item analysis, pre-posttest design, skills inventory, survey, etc.)

   ENGR 301: Quiz, lab experiments, midterm exam, and final exam were used.
   ENGR 101: Projects, Midterm exam, and excel project were used.
   ENGR 479: Final report, Oral presentation, Final drawings, PEER Evaluation, and Overall performance were used.

   Rubic were used to assess each outcomes.

4. **How many students were included in the assessment(s) of each PLO in a course?**

   ENGR 101 – 9 students

ENGR 301 – 2 students
ENGR 479 – 2 students

5. **How were students selected to participate in the assessment of each outcome (**Helpful details might include- whether this assessment represents all students, a sample of students in a class, or a sample of students across sections)?

   The assessment represents all the students in the respective courses.

6. **In general, describe how each assessment tool (measure) was constructed** (i.e. in-house, national, adapted).

All instruments were constructed in-house.

7. **Who analyzed results and how were they analyzed**

Initial assessments were performed by all the faculty members of the Engineering Program. These were then discussed by the program assessment committee.

8. **Provide a summary of the results/conclusions from the assessment of each measured Program Learning Outcome.** *Report scores for this assessment, as well as students' strengths and weaknesses relative to this learning outcome.*

Data: ENGR 301, Spring 2024

ENGR 301 - Fluid Mechanics		
Spring 2024		
Course Outcome #1: Understand the properties of fluids and fluid statics (calculate the hydrostatic pressure and force on plane and curved surfaces, problems on buoyancy, etc.).		
Measure:	Quiz #1	
Total number of students =	2	
	Student	**Assessment score (1 to 5)**
	Std#1	2
	Std#2	4

ENGR 301 - Fluid Mechanics
Spring 2024

Course Outcome #1: Understand the properties of fluids and fluid statics (calculate the hydrostatic pressure and force on plane and curved surfaces, problems on buoyancy, etc.).

Measure: Lab Report

Total number of students = 2

Student	Assessment score (1 to 5)
Std#1	5
Std#2	5

ENGR 301 - Fluid Mechanics
Spring 2024

Course Outcome #2: Understand fluid dynamics

Measure: Final Exam, Question #1

Total number of students = 2

Student	Assessment score (1 to 5)
Std#1	4
Std#2	4

ENGR 301 - Fluid Mechanics
Spring 2024

Course Outcome #3: Ability to evaluate flows in piping systems (use important concepts of continuity equation, Bernoulli's equation, etc.).

Measure: Final Exam, Question #4

Total number of students = 2

Student	Assessment score (1 to 5)
Std#1	4
Std#2	4

ENGR 301 - Fluid Mechanics		
Spring 2024		
Course Outcome #3: Ability to evaluate flows in piping systems (use important concepts of continuity equation, Bernoulli's equation, etc.).		
Measure: Lab Report		
Total number of students =	2	
	Student	**Assessment score (1 to 5)**
	Std#1	5
	Std#2	5

ENGR 301 - Fluid Mechanics		
Spring 2024		
Course Outcome #4: Ability to evaluate flow in open channels (sub-critical, critical, and super-critical flows, normal depth, etc.).		
Measure: Final Exam, Question #5		
Total number of students =	2	
	Student	**Assessment score (1 to 5)**
	Std#1	5
	Std#2	5

Data: ENGR 479, Fall 2023

ENGR 479 - Senior Seminar		
Fall 2023		
Course Outcome #1: Apply knowledge, problem solving skills and proper process(es) to design a civil engineering project while effectively working in a team environment.		
Measure:	Overall performance	
Total number of students =	2	
	Student	**Assessment score (1 to 5)**
	Std#1	5
	Std#2	4

ENGR 479 - Senior Seminar
Fall 2023

Course Outcome #1: Apply knowledge, problem solving skills and proper process(es) to design a civil engineering project while effectively working in a team environment.

Measure: PEER Evaluation

Total number of students = 2

Student	Assessment score (1 to 5)
Std#1	5
Std#2	5

ENGR 479 - Senior Seminar
Fall 2023

Course Outcome #2: Ability to use computer-aided drafting to produce design drawings.

Measure: Final Drawings

Total number of students = 2

Student	Assessment score (1 to 5)
Std#1	5
Std#2	4

ENGR 479 - Senior Seminar					
Fall 2023					
Course Outcome #3: Produce appropriate oral presentations					
Measure:	Oral Presentation				
Total number of students =			2		
	Student	**Assessment score (1 to 5)**			
	Std#1		5		
	Std#2		4		

ENGR 479 - Senior Seminar				
Fall 2023				
Course Outcome #4: Final Report				
Measure:	Final Report			
Total number of students =			2	
	Student	**Assessment score (1 to 5)**		
	Std#1		5	
	Std#2		5	

Data: ENGR 101, Fall 2023

ENGR 101 - Intro to Problem Solving I		
Fall 2023		
Course Outcome #1: Apply knowledge in mathematics, science, and engineering to solve engineering problems while effectively working in a team environment.		
Measure: Project 1: Manilla Folder Bridge		
Total number of student =	9	
Student	**Assessment score (1 to 5)**	
Std#1	5	
Std#2	4	
Std#3	5	
Std#4	5	
Std#5	4	
Std#6	4	
Std#7	5	
Std#8	5	
Std#9	4	

ENGR 101 - Intro to Problem Solving I		
Fall 2023		
Course Outcome #2: Develop an ability to make ethical decisions to engineering issues presented in case studies.		
Measure: Midterm Exam, Part 1		
Total number of student =	9	
Student	**Assessment score (1 to 5)**	
Std#1	4	
Std#2	3	
Std#3	5	
Std#4	5	
Std#5	3	
Std#6	3	
Std#7	5	
Std#8	5	
Std#9	4	

ENGR 101 - Intro to Problem Solving I					
Fall 2023					
Course Outcome #3: Use Microsoft Excel to analyze data.					
Measure: Project #2, Excel Project					
Total number of student =			9		
	Student	**Assessment score (1 to 5)**			
	Std#1	5			
	Std#2	5			
	Std#3	5			
	Std#4	4			
	Std#5	4			
	Std#6	4			
	Std#7	5			
	Std#8	5			
	Std#9	2			

ENGR 101 - Intro to Problem Solving I								
Fall 2023								
Course Outcome #4: Produce appropriate oral presentations to show project results.								
Measure: Project 3, Trebuchet								
Total number of student =			9					
	Student	**Assessment score (1 to 5)**						
	Std#1	3						
	Std#2	4						
	Std#3	4						
	Std#4	3						
	Std#5	4						
	Std#6							
	Std#7	4						
	Std#8	4						
	Std#9	4						

ENGR 101 - Intro to Problem Solving I								
Fall 2023								
Course Outcome #5: Produce appropriate written documents to report project results.								
Measure: Project 3, Trebuchet Report								
Total number of student =			9					
	Student	**Assessment score (1 to 5)**						
	Std#1	4						
	Std#2	4						
	Std#3	4						
	Std#4	4						
	Std#5	4						
	Std#6							
	Std#7	4						
	Std#8	4						
	Std#9							

As per Accreditation Board for Engineering and Technology (ABET), Program Learning Outcomes (PLO) is divided into two categories: (i) Program Educational Objectives (PEO), and (ii) Student Outcomes (SO).

Student Outcomes (SO)

Student Outcomes (SO)	Average Assessment Scores (Scale 5)				Avg Score for SO
	ENGR 101		ENGR 301	ENGR 479	
1. an ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics.	4.4		4.3	4.5	**4.4**
2. an ability to apply engineering design to				4.6	**4.6**

produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors.					
3. an ability to communicate effectively with a range of audiences.	3.1			4.8	**4.0**
4. an ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts.	4.1			4.8	**4.5**
5. an ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives.	4.2			5.0	**4.6**
6. an ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions.			4.3		**4.3**
7. an ability to acquire and apply new knowledge as needed, using appropriate learning strategies.				4.5	**4.5**

As can be seen from the above table, students are performing above the expected level for all Student Outcomes (SO).

Program Educational Objectives (PEO)

PEOs	Student Outcomes (SO) mapped to Program Educational Objectives (PEO)							**Avg Scores for PEO**
	SO 1	SO 2	SO 3	SO 4	SO 5	SO 6	SO 7	
PEO 1	4.4	4.6		4.5		4.3	4.5	**4.5**
PEO 2			4.0	4.5	4.6			**4.4**
PEO 3	4.4	4.6				4.3	4.5	**4.5**

As can be seen from the above table, students are performing above the expected level for all Program Educational Objectives (PEO).

9. **What are next steps?** (e.g., will you measure this same learning outcome again? Will you change some feature of the classroom experience and measure its impact? Will you try a new tool? Are you satisfied?)

   Our plan is to continue with the same Student Outcomes (SO) and Program Educational Objectives (PEO).

   We are satisfied with the current approach.

10. **Please attach an example of the assessment tool used to measure your PLO(s).** These can be added as an appendix, a link to the assessment, or sent separately in email with your report.

ENGR 101: Midterm Exam

NAME: _____

PART 1: MULTIPLE CHOICE Directions: Read each question carefully, and then CIRCLE THE ANSWER that best fits the question. If you have questions, raise your hand and ask your teacher. [15-points total with each question being worth 5 points].

1. Registered professional engineers should undertake services for clients only when:

A) They really need the fees
B) Their own bid is the lowest one
C) They are fully technically competent to carry out the services
D) Carrying out the services wouldn't involve excessive time or effort

2. With respect to the Moral Rules of Professional Conduct for engineers:

A) The rules are a bad thing because they encourage engineers to spy on and betray their colleagues
B) The rules are a useful legal defense in court, when engineers can demonstrate that they obeyed the rules
C) The rules enhance the image of the profession and hence its economic benefits to its members
D) The rules are important in providing a summary of what the public has the right to expect from responsible engineers

3. You are a quality control engineer, supervising the completion of a product whose specifications includes using only U.S.-made parts. However, at a very late stage you notice that one of your sub-contractors has supplied you with a part having foreign-made bolts in it-but these aren't very noticeable, and would function identically to U.S.-made bolts. Your customer urgently needs delivery of the finished product-what should you do?

A) Say nothing and deliver the product with the foreign bolts included, hoping this fact won't be noticed by the customer
B) Find (or, if necessary, invent) some roughly equivalent violation of the contract or specifications for which the customer rather than the company is responsible-then tell them you'll ignore their violation if they ignore your company's violation
C) Tell the customer about the problem, and let them decide what they wish you to do next
D) Put all your efforts into finding legal loopholes in the original specifications, or in the way they were negotiated, to avoid your company's appearing to have violated the specifications.

WEST VIRGINIA STATE UNIVERSITY	*ENGR 101*	***Dr. Mohammad T Bhuiyan*** Email: towhid@wvstateu.edu

PROBLEM SOLVING using SPREADSHEET AND GRAPHS

LIFE OF A LOAN

OBJECTIVE:

Most engineers will be involved in decision-making processes regarding the acquisition of equipment, machines, real estate, and other assets. These analyses will require the knowledge of financial functions. Therefore, Engineering Departments at many Universities offer courses on ENGINEERING ECONOMICS. The objective of this particular assignment is to use some of the financial functions of a spreadsheet program (Excel) to analyze the life of a loan along all payment periods.

PROBLEM DESCRIPTION:

A company needs to acquire a small vehicle to be used by employees of the inspection department to travel from the central office to other plant facilities and perform all necessary inspections in a weekly basis. For this purpose, you, the engineer in charge of the Inspection Department, are required to prepare a spreadsheet capable of analyzing the life of a loan during 48 monthly periods.

Use the provided spreadsheet and graph to prepare a similar analysis. Your spreadsheet should be able to analyze many different loans (**different loan amounts** and **different annual interest rate**). However, all of them should be paid by equal monthly payments during **48 months**. In addition, a column should show the **Accumulated Total Payments** at the end of each period

Use the following three common financial functions: **PMT**, **IPMT**, and **PPMT**. Their use is fully described in the attached pages, which were obtained from the help function of Excel. However, a quick description of their use is given in the following statements:

PMT = Amount of each periodic constant payment necessary to cancel the debt in a given number of periods.
IPMT = Amount (portion) of a periodic payment that is used to pay interests in a given period.

PPMT = Amount (portion) of a periodic payment that is used to cancel the debt (principal) in a given period.

Each of these functions involves the following parameters (they are given between parentheses):

PMT(periodic-interest-rate, number-of-periods, original-load-amount)
IPMT(periodic-interest-rate, current-period, number-of-periods, original-load-amount)
PPMT(periodic-interest-rate, current-period, number-of-periods, original-load-amount)

Also, prepare a graph similar to the attached one. It should contain a line showing the amount of **Accumulated Interest Payments**, another line showing the **Accumulated Principal Payments**, another line showing the **Accumulated Total Payments**, and a line showing the **Remaining Debt** at the end of each period.

Please, follow all additional instructions provided in class.

ENGR 101: Trebuchet Project

West Virginia State University

Trebuchet Competition

Project 3

Design Rules

1. The counterweight (see mass m1 in Fig. 1) will be up to 4 unopened cans of soda (you may use fewer). The counterweight must be detachable and must be
   (a) Dangling throughout the entire throwing motion (makes no contact with other parts of the trebuchet throwing arm: L2+L5 in Fig. 1).

   Or

   (b) must be rigidly attached to the arm (can't slide, jiggle, etc…). If the cans are rigidly attached to the arm, it will be included in measurements of the arm's length. Rigid is defined as anything other than dangling. If the counterweight comes in contact with the throwing arm, it will be treated as part of the arm for qualification purposes (see Fig. 2).

2. The throwing arm (length L2+L5 in Fig. 1) must be no longer than 3 feet. The length includes the sling hook (where L5 and L3 meet), any mechanism or harness used to attach the counterweight (where L1 and L2 meet), and the counterweight itself if contact is made (see #1). The top pivoting lever may not be less than ¼" thick.
3. The throwing arm (length L2+L5 in Fig. 1) must be balanced toward the projectile end (see L5) throughout the entire range of motion. It may not be collapsible. The arm cannot be locked in place while testing for balance. Testing will be performed by removing the counterweight and projectile, lifting the projectile end all the way to within 1 inch of the vertical using a pencil, and lowering the arm back to the ground to the cocked position and should not leave contact with the pencil during the testing motion. If the throwing arm leaves contact with the pencil while lifting, or leaves contact with the ground while in the cocked position, it is not in compliance.
4. The height of the center of the pivot point (H) must be less than or equal to 2 feet 2 inches from the ground.
5. All connecting hardware must remain in place during testing. Only the counterweight (soda cans) and projectile may be removed. Any fastening devices/holders/brackets to be used during the competition will be included as part of the arm during the balance test. This includes the sling hook and the counterweight attachment mechanism. You will not be allowed to augment the counterweight in any way (other than an allowance of up to 30" of duct tape used to hold cans together).

6. A firing release mechanism is NOT required. However, inclusion of a working firing mechanism is encouraged. If a mechanism exits, it does NOT have to be used in competition.
7. No catapults or catapult/trebuchet hybrids are allowed. Only stored energy due to gravity is allowed. You are not allowed to store energy by deformation of components. This means no springs, rubber bands, flexible arms, etc. No pulleys or ball bearings are allowed.
8. The counterweight must be attached to the end of the throwing arm, not looped over.
9. Trebuchets will be inspected for safety. Loose parts must be tightened before competing. No part of the trebuchet is allowed to become completely disconnected from the trebuchet (this includes counterweights falling off). If a part becomes completely disconnected, the trebuchet will be deemed 'lost in battle' and must be removed from the competition. Any trebuchet that is considered to be unsafe by the judges will be disqualified.
10. Trebuchets must not have any protruding parts that may damage the surface of the playing field. No metal may protrude below wood or other softer material.
11. Recoiling trebuchets (wheels) are allowed as long as they remain on a platform (board) that contains them. Floating arm trebuchets are allowed but must be fired in the same manner as other trebuchets. The trebuchet cannot be fired by manually dropping weight onto the throwing arm. Trebuchets can only be fired by releasing the throwing arm or sling. No other part of the trebuchet may be touched during the launch process.
12. Each trebuchet must have a target. This will be one of the targets the other team will shoot at so the operator must not obstruct the target opening. If an operator intentionally or consistently obstructs the target, the trebuchet will be disqualified and removed from the playing filed.
13. The projectiles will be regulation soft squash balls of a variety of sizes and weights. Operators must compensate for differences between projectiles.
14. Expected throws are in the range of 30-45 feet. If your trebuchet cannot consistently hurl projectiles this distance, you will likely not do well in the competition.

Teams

1. A team consists of 3 positions: a captain, an assistant, and up to 3 trebuchets, with one operator per trebuchet. The team advisors may fill the roles of captain and assistant only.
2. The team is defined by the group of trebuchets. A team may have no more than 5 members. Members not operating trebuchets may retrieve ammunition on their half of the field only.
3. Teams of up to 3 trebuchets (one per trebuchet operator, and only one operator per trebuchet) will compete in a head-to-head competition.
4. Each trebuchet must be operated by only one person. The operator may not move away from the trebuchet. If the trebuchet is left unattended, it is considered 'destroyed by sabotage' and must be removed from the playing field.

5. The captain and assistant may not enter the playing field during competition. They may give direction from outside the playing field and may recover ammunition that leaves the playing field (on their own half).
6. Each operator on the playing field must wear safety goggles or glasses that will protect the eye. Trebuchets may not be operated by players without proper eye protection.

Matches

1. The competition field will be a rectangle 20 feet wide and 50 feet long. Opposing teams will occupy 20'x20' battle regions at either end of the competition field. The 10'x20' region between the two battle regions is considered 'no man's land'. No part of a trebuchet may extend into this area. The playing field will be marked.
2. Teams may position their trebuchets anywhere within their battle region. However, once placed, they cannot be moved forwards, backwards, nor sideways during competition. Trebuchets may be rotated to acquire targets.
3. Each team will have one kill target that may be placed anywhere in their battle region. If your team scores this target in the opponents field, your team wins by default. The kill target may not be moved or blocked during competition. The kill target will be ring stand with a 4-inch ring. The height of the kill target must be between 24" and 36" from the playing surface.
4. The height and location of the kill target may not change during competition, but may be adjusted between rounds.
5. The trebuchet targets must be placed immediately in front of the trebuchet and must not be moved during the battle.
6. If your team destroys all trebuchets of the opposing team, your team wins by default.
7. Each team will have two multiple-scoring field targets (targets that can be scored multiple times) that are stationary in their battle region. These targets may not be moved or blocked during competition. Field targets will be small plastic trash cans or buckets. Actual targets and sizes may change from match to match, but within a given match both teams will have the same size targets.
8. Point values for scoring targets: Trebuchet target – 100 points

   Field scoring target (large) – 15 points

   Kill target – Automatic win

9. Operators may adjust or reattach the sling during competition. The sling does not fall under the design rule about components of the trebuchet becoming disconnected. Other minor repairs may be allowed at the judge's discretion.

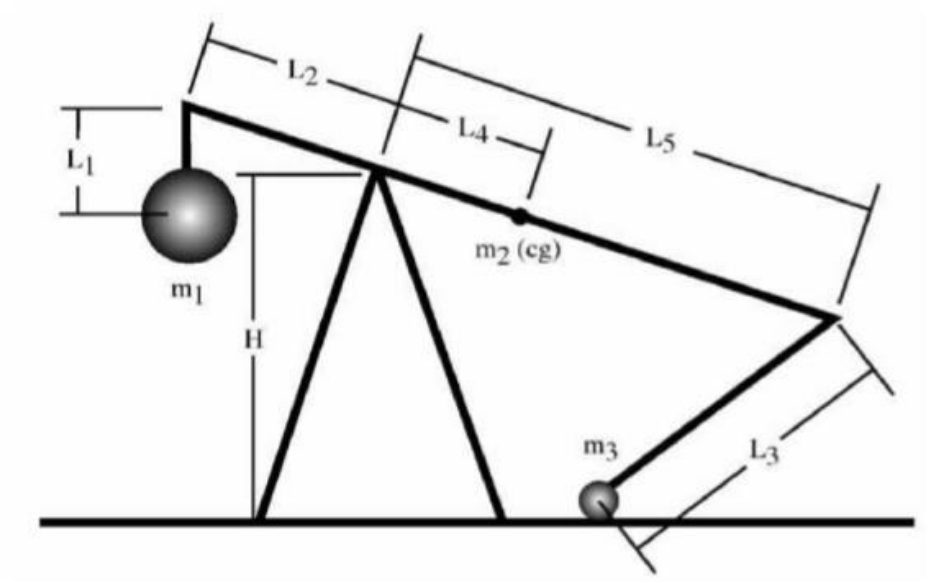


Figure 1: Trebuchet

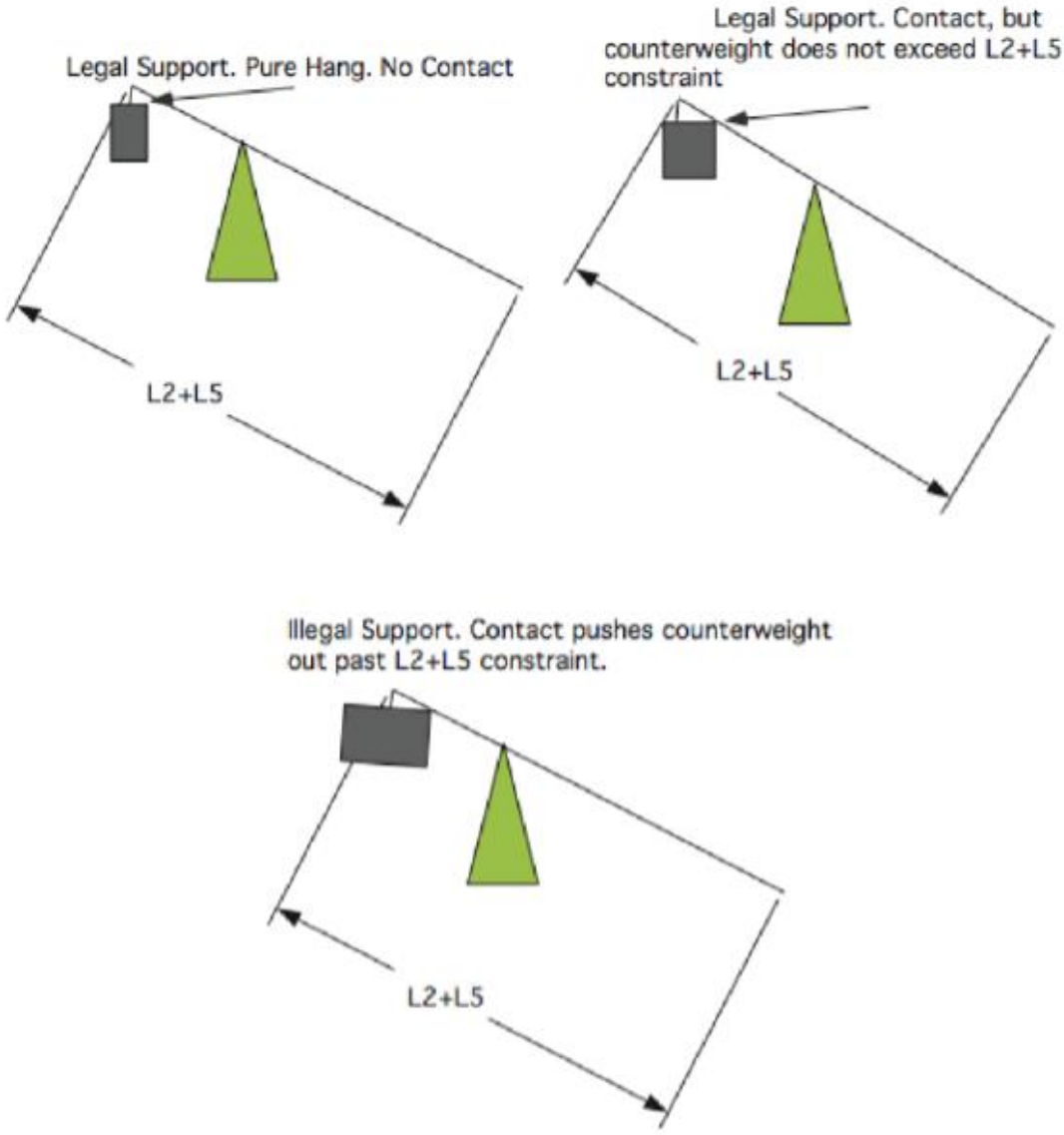
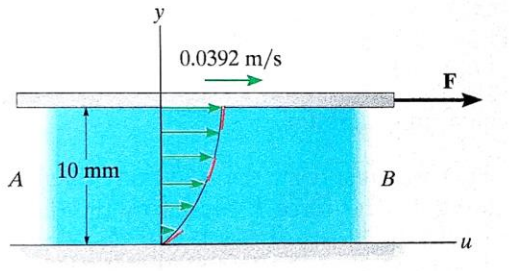


Figure 2: Counterweights

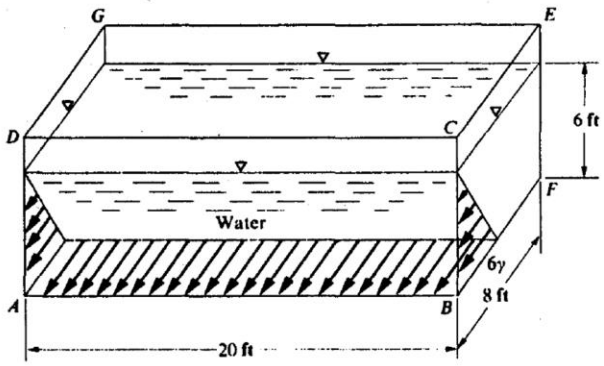
ENGR 301 - Fluid Mechanics (Spring 2024)

CO #1: Quiz #1 and Lab Reports

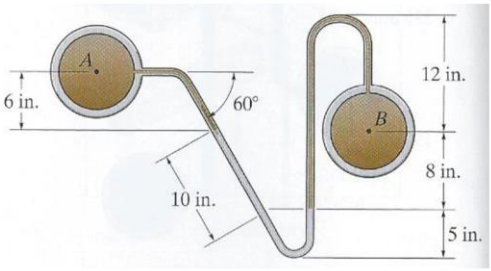
1- The plate in the figure rests on top of the thin film of water, which is at a temperature of 25 °C. There is a pressure difference between A and B, and a small force F is applied to the plate. This causes the velocity profile across the thickness of the water to be nonlinear, but rather described as $u = (4y - 8y^2)$ m/s, where y is in meters. Determine the shear stress acting on the fixed surface and on the bottom of the plate.



2- A tank containing water is shown in the Figure below. Calculate the total resultant force acting on the side ABCD of the container and the location of the center of pressure.



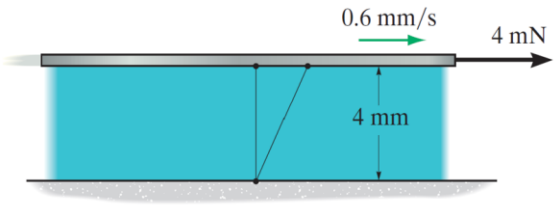
3- The pipes at A and B contain oil and the inclined-tube manometer is filled with oil and mercury. Determine the pressure difference between A and B. ($\rho_{Oil} = 800\ \frac{kg}{m^3}$; $\rho_{Mercury} = 13{,}546\ \frac{kg}{m^3}$; 1 inch = 2.54 cm)



4- Determine the submerged depth of a cube of steel 0.30 m on each side floating in mercury. The specific gravities of steel and mercury are 7.8 and 13.6, respectively.

CO #2: Final Exam, Question #1

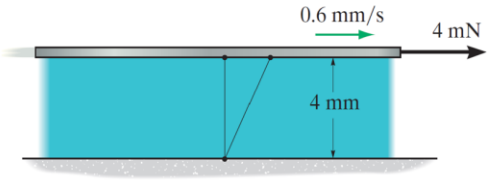
1- The plate is moving at 0.6 mm/s when the force applied to the plate is 4 mN. If the surface area of the plate in contact with the liquid is 0.5 m^2, determine the approximate viscosity of the liquid, assuming that the velocity distribution is linear.



$$\tau = \mu \frac{du}{dy}$$

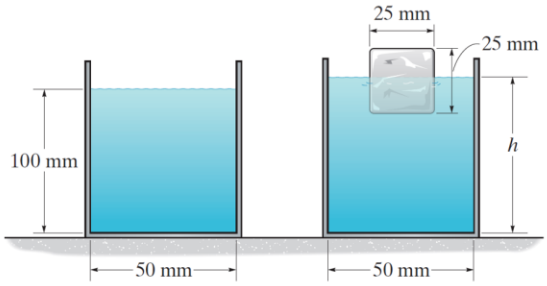
CO #3: Final Exam and Lab Reports

1- The plate is moving at 0.6 mm/s when the force applied to the plate is 4 mN. If the surface area of the plate in contact with the liquid is 0.5 m^2, determine the approximate viscosity of the liquid, assuming that the velocity distribution is linear.

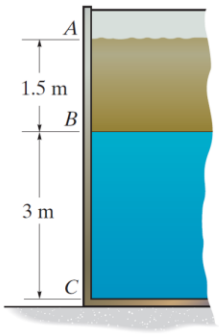


$$\tau = \mu \frac{du}{dy}$$

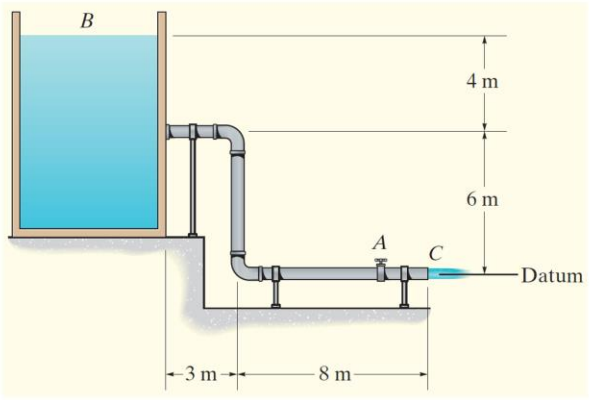
2- A glass having a diameter of 50 mm is filled with water to the level shown. If an ice cube with 25-mm sides is placed into the glass, determine the new height h of the water surface. Take ρ_w = 1000 kg/m^3 and ρ_{ice} = 920 kg/m^3. What will the water level h be when the ice cube completely melts? [Simple physics and geometry question! Do not overthink!]



3- Determine the resultant force that the water and oil together exert on the wall *ABC*. The wall has a width of 2 m. Also, determine the location of this resultant measured from the top of the tank. Take ρ_o = 900 kg/m^3, and ρ_w = 1000 kg/m^3. [Fluid mechanics and simple statics question! Do not overthink!]



4- Determine the required diameter of the galvanized iron pipe if the initial discharge at *C* is to be 0.475 m^3/s when the gate valve at *A* is fully opened. The reservoir is filled with 20 °C water to the depth shown.



$$\frac{p_{in}}{\gamma} + \frac{{V_{in}}^2}{2g} + z_{in} = \frac{p_{out}}{\gamma} + \frac{{V_{out}}^2}{2g} + z_{out} + f\frac{L}{D_h}\frac{V^2}{2g} + \sum K_L\left(\frac{V^2}{2g}\right)$$

5- A rectangular channel has a width of 2 m. If the flow is 5 m^3/s, determine the Froude number when the water depth is 1.5 m. At this depth, is the flow subcritical or supercritical? Also, what is the critical speed of the flow?

$$\mathrm{Fr} = \frac{V}{\sqrt{gy}}$$

CO #4: Final Exam, Question #5

5- A rectangular channel has a width of 2 m. If the flow is 5 m^3/s, determine the Froude number when the water depth is 1.5 m. At this depth, is the flow subcritical or supercritical? Also, what is the critical speed of the flow?

$$\mathrm{Fr} = \frac{V}{\sqrt{gy}}$$