

Name: _____ CM Box: _____

Circle your section:

Sanders – 01

Sanders – 02

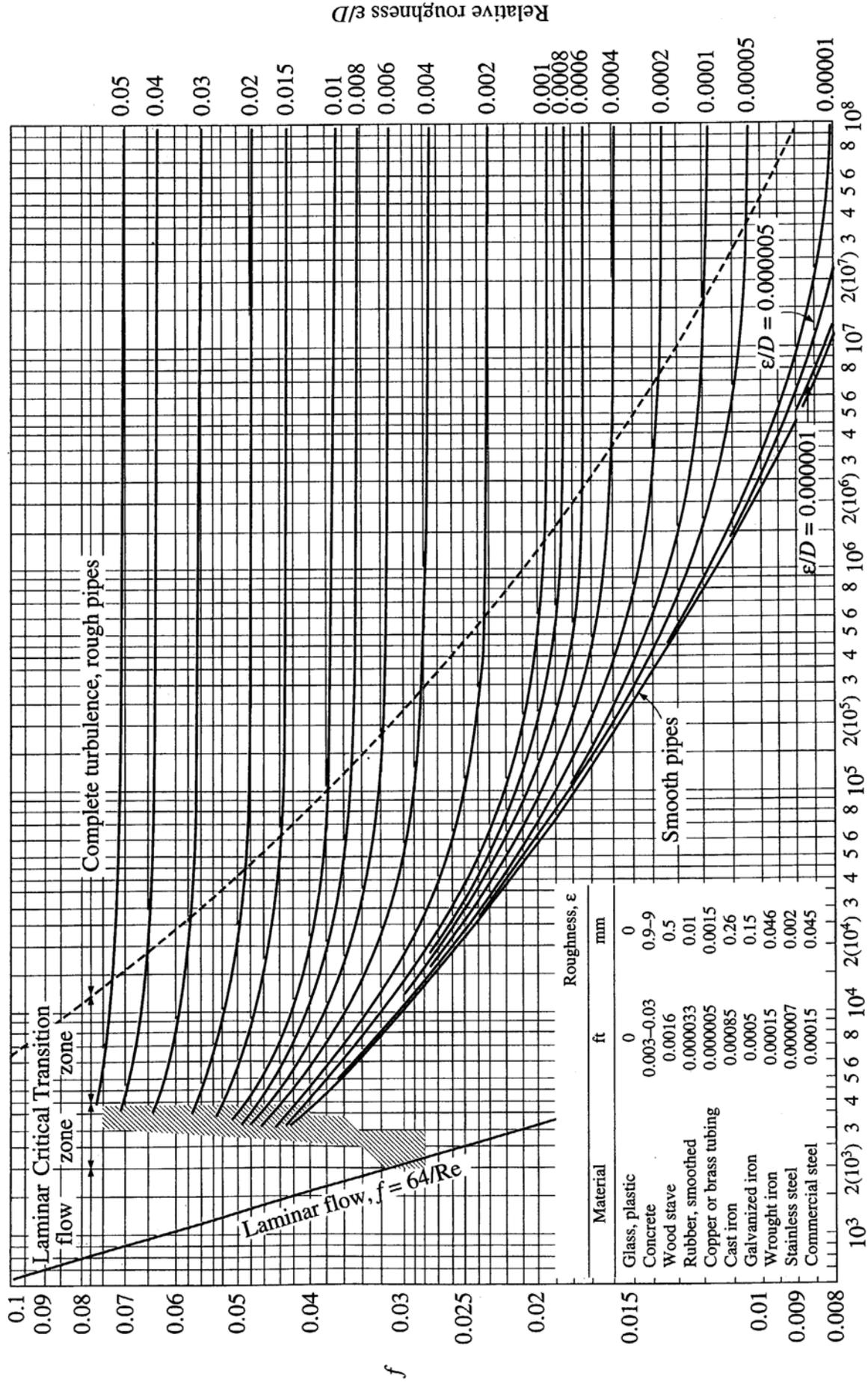
Lui – 03

ES 202
Fluid & Thermal Systems

Examination III
May 12, 2005

Problem	Score
1	/ 30
2	/ 70
Total	/ 100

Show your work clearly for credit
One page of equation sheet allowed
Laptops allowed

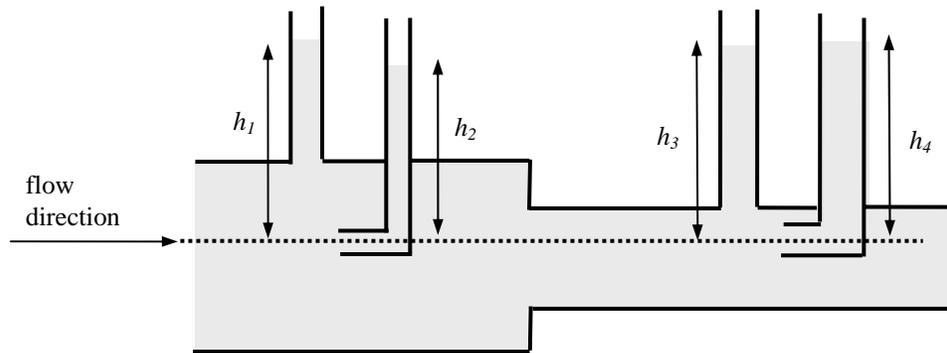


Material	Roughness, ϵ	
	ft	mm
Glass, plastic	0	0
Concrete	0.003-0.03	0.9-9
Wood stave	0.0016	0.5
Rubber, smoothed	0.000033	0.01
Copper or brass tubing	0.000005	0.0015
Cast iron	0.00085	0.26
Galvanized iron	0.0005	0.15
Wrought iron	0.00015	0.046
Stainless steel	0.000007	0.002
Commercial steel	0.00015	0.045

Reynolds number Re

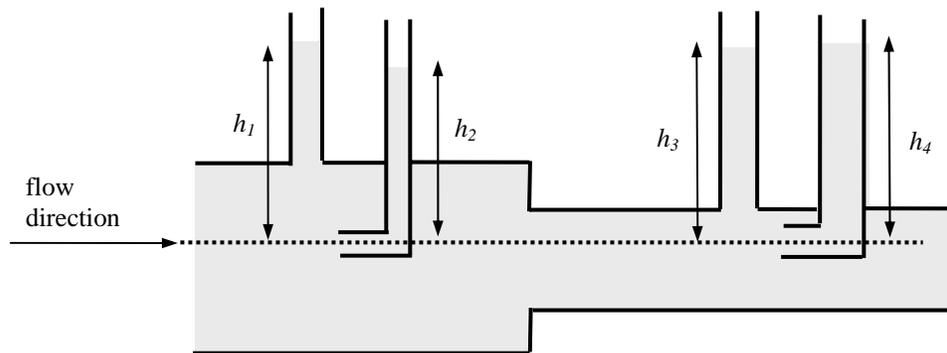
Problem 1 (30 points)

a) In the ABSENCE of fluid friction, arrange the value of h_1 , h_2 , h_3 and h_4 in ascending order.



Answer:

b) In the PRESENCE of fluid friction, arrange the value of h_1 , h_2 , h_3 and h_4 in ascending order.



Answer:

c) Circle the correct answer: In a laminar pipe flow, an increase in surface roughness will

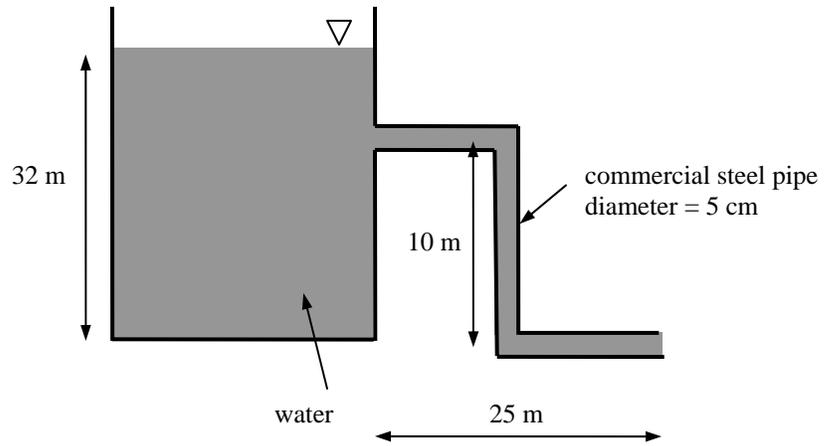
- i. increase the head loss.
- ii. decrease the head loss.
- iii. have no effect on the head loss.
- iv. either increase or decrease the head loss.

d) Circle the correct answer: In a turbulent pipe flow, an increase in surface roughness will

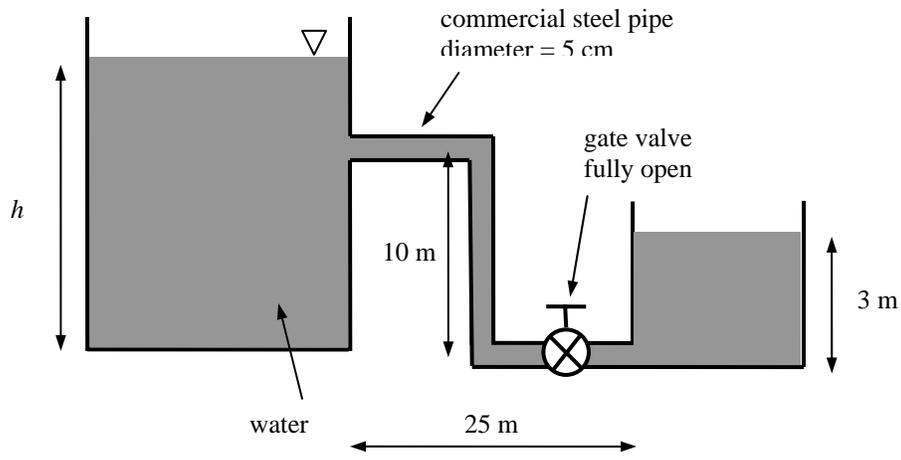
- i. increase the head loss.
- ii. decrease the head loss.
- iii. have no effect on the head loss.
- iv. either increase or decrease the head loss.

Problem 2 (70 points)

- (a) Assume there are no losses due to fluid friction. Determine the flow speed of water at the pipe exit. Properties of water: $\rho = 1000 \text{ kg/m}^3$, $\mu = 0.001138 \text{ kg/m}\cdot\text{s}$.



- (b) With fluid friction taken into account, what is the value of h so that the same flow speed as that in Part (a) is to be sustained in the following system? Assume all 90° bends are smooth and threaded.



Hint: Work out the problem in symbols. Substitute numbers at the end.

