Misurata University
Faculty of Engineering – Mechanical Engineering Department
Fall Semester 2013 Fluid Mechanics II Final Exam 2.5 hr

(1-a) What is meant by (a) Potential head, (b) Pressure head, (c) velocity head and (d) Total head for a liquid in motion?

(1-b) A jet of water from a 25 mm diameter nozzle is directed vertically upwards. Assuming that the jet remains circular and neglecting any loss of energy what will be the diameter of the jet at a point 4.5 m above the nozzle if the velocity with which the jet leaves the nozzle is 12 m/s.

(2-a) Drive an expression for the actual volumes flow rate through Rectangular and Triangular Notches.

(2-b) Find the discharge through a trapezoidal notch which is 1. m wide at the top and 0.4 m at the bottom and is 30 cm in height. The head of water on the notch is 20. cm. Assume C_d for rectangular portion as 0.62 while for triangular portion as 0.6.

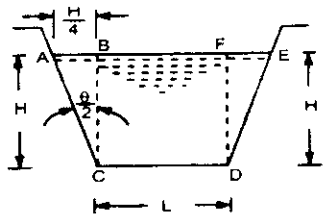


Fig. 5.50 ***The cipolletti weir.***

(3-a) A circular orifice 3.5 cm diameter is made in the vertical wall of a tank. The jet falls vertically through 0.5 m while moving horizontally through a distance of 1.5 m. Calculate the coefficient of velocity of the head causing flow is 1.2 meters. If the discharge is 2.8 x 10^{-3} m^3/s calculate C_c and C_d .

(3-b) The drop in pressure Δp due to an obstruction in a pipe depends on the pipe diameter D, mean velocity V, mass density ρ and viscosity of fluid μ, Show that $\frac{\Delta p}{\rho V^2} = \phi[(L/D),(\rho VD/\mu)]$ where L is characteristic length of obstruction.

(4-a) Drive an Expression for the actual flow rate throw an Oriffce meter.

(4.b) A Venturimeter is placed in a vertical line to measure the rate of flow of benzene (Sp. Gr. = 0.899). The inlet dia. of the Venturimeter is 20 cm and the throat dia. is 8.75 cm. Benzene mercury differential manometer gauge is used to measure the differential pressure between the inlet and the throat of the meter. When the gauge reading is 10 cm assuming a C_d = 0.99 and Sp.Gr of mercury = 13.55 determine (i) gauge reading in cm of benzene (ii) throat velocity, and (iii) discharge.

(5-a) Drive an expression for the Velocity of fluid flow rate throw a pipe line, the shear stress, Volume flow rate and The average velocity.

(5.b) What size of pipe would be required to carry 176.58 N of oil (Sp.gr = 0.9, ν = 0.0002 m^2/s) per sec through a 300 m long horizontal pipe? The loss of head in the pipe is 7 m of oil.

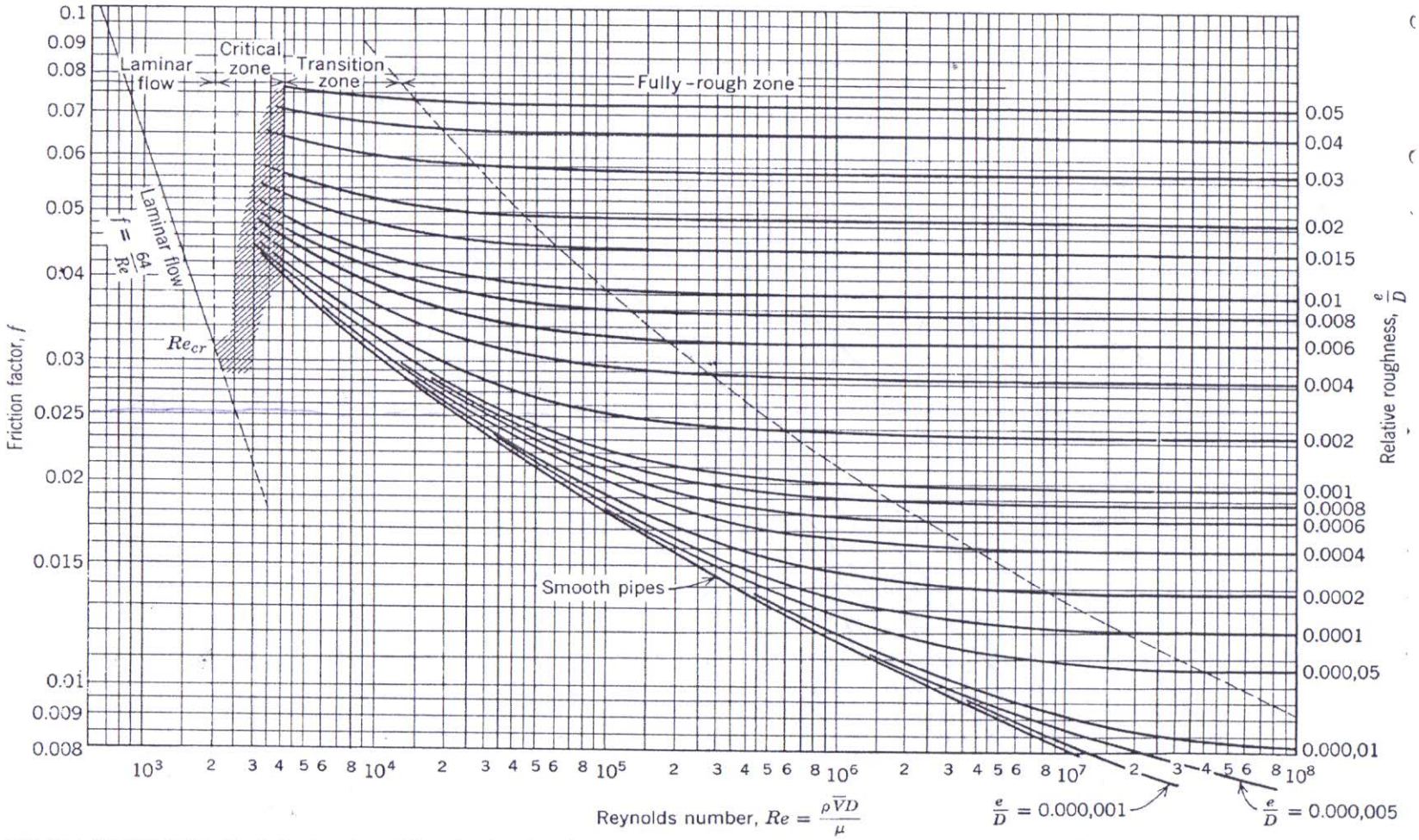
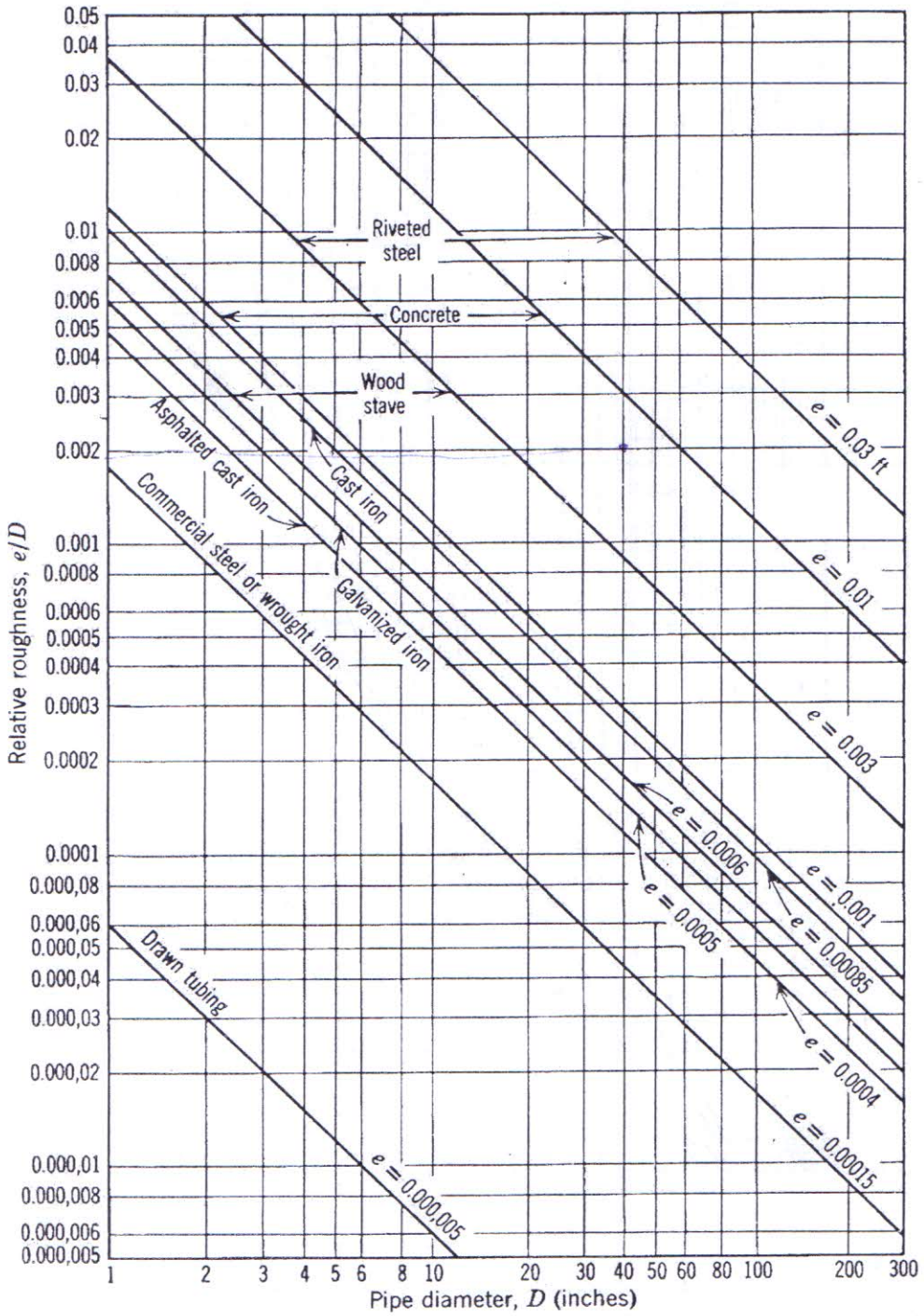


Fig. 9.12 Friction factor for fully-developed flow in circular pipes (data from Ref. 1, used by permission).


Relative roughness, e/D
0.05
0.04
0.03
0.02
0.01
0.008
0.006
0.005
0.004
0.003
0.002
0.001
0.0008
0.0006
0.0005
0.0004
0.0003
0.0002
0.0001
0.000,08
0.000,06
0.000,05
0.000,04
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0.000,02
0.000,01
0.000,008
0.000,006
0.000,005
Riveted steel
Concrete
Wood stave
Asphalted cast iron
Cast iron
Commercial steel or wrought iron
Galvanized iron
Drawn tubing
e = 0.03 ft
e = 0.01
e = 0.003
e = 0.0006
e = 0.001
e = 0.0005
e = 0.00085
e = 0.0004
e = 0.00015
e = 0.000,005
1
2
3
4
5
6
8
10
20
30
40
50
60
80
100
200
300
Pipe diameter, D (inches)