PRINCE OF SONGKLA UNIVERSITY

FACULTY OF ENGINEERING

Mid-term Examination Paper: Semester I **Academic year: 2014**

Date: October 13rd, 2014 **Time: 9.00-12.00**

Subject: 231-311 Momentum and Heat Transfer **Room: S817**

ชื่อ-นามสกุล ..... รหัสนักศึกษา .....

หมายเหตุ

1. ข้อสอบมีทั้งหมด .....9..... ข้อ ในกระดาษคำถาม .....10..... หน้า (รวมปก) และเอกสารประกอบการสอบ 4 หน้า (A1-A4)
2. ห้ามการหยิบยืมสิ่งใด ๆ ทั้งสิ้น จากผู้อื่น ๆ เว้นแต่ผู้คุมสอบจะหยิบยืมให้
3. ห้ามนำส่วนใดส่วนหนึ่งของข้อสอบออกจากห้องสอบ
4. ผู้ที่ประสงค์จะออกจากห้องสอบก่อนหมดเวลาสอบ **แต่ต้องไม่น้อยกว่า 30 นาที** ให้ยกมือขออนุญาตจากผู้คุมสอบก่อนจะลุกจากที่นั่ง
5. เมื่อหมดเวลาสอบ ผู้เข้าสอบต้องหยุดการเขียนใด ๆ ทั้งสิ้น
6. ผู้ที่ปฏิบัติเข้าข่ายทุจริตในการสอบ ตามประกาศคณะวิศวกรรมศาสตร์ **มีโทษ คือ ปรับตกในรายวิชาที่ทุจริต และพักการเรียน 1 ภาคการศึกษา**
7. ให้นักศึกษาสามารถนำสิ่งต่อไปนี้เข้าห้องสอบได้

   ☑ เครื่องคิดเลข ☐ พจนานุกรม
8. ให้ทำข้อสอบโดยใช้

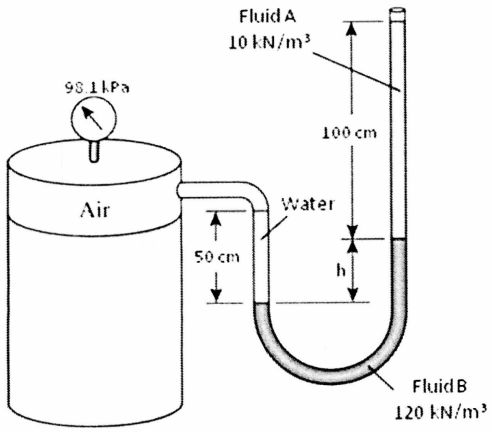
   ☑ ดินสอ ☑ ปากกา

ข้อ	1	2	3	4	5	6	7	8	9	รวม
คะแนนเต็ม	10	15	5	15	10	10	15	5	5	90
ทำได้										

ผู้ออกข้อสอบ ณัฐวรรณ กลัดแก้ว

Student ID | 5 | | 1 | 0 | 1 | 1 | 0 | | | |

1. (10 points) The gage pressure of the air in the tank is measured to be 98.1 kPa. Determine the differential height *h* of the fluid B column in centimeter.



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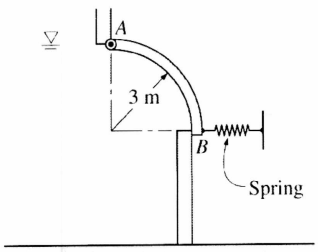
2. (15 points) A 4-m-long quarter-circular gate of radius 3 m and of negligible weight is hinged about its upper edge A. The gate controls the flow of water over the ledge at B, where the gate is pressed by a spring. Determine the magnitude and direction of the hydrostatic force acting on the gate.



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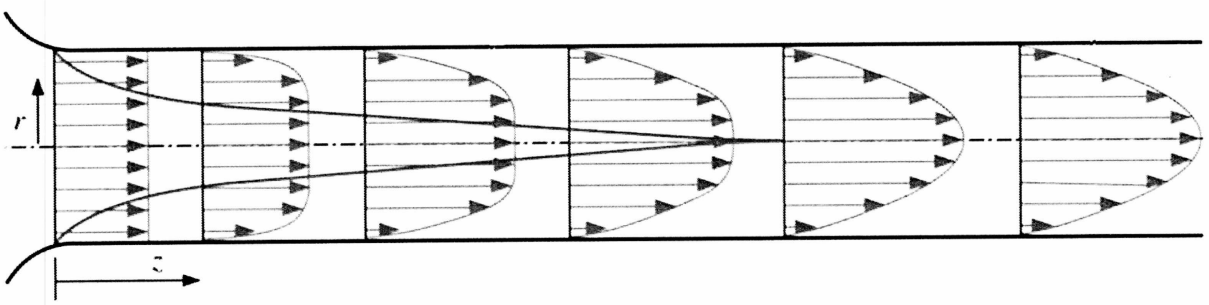
3. (5 points)

(3.1) (2. points) Give <u>two examples</u> of the classification of fluid flows

(3.2) (3 points) Define each velocity profile whether it is one-, two- or three- dimensional flows.



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4. (15 points) Water enters a hydraulic turbine through a 50-cm-diameter pipe at a rate of 1 m^3/s and exits through a 35-cm-diameter pipe. The pressure drop in the turbine is measured to be 150 kPa. For a combine turbine-generator efficiency of 85 percent, determine the net electric power output. The irreversible head loss is 0.11 m. Disregard the effect of the kinetic energy correction factors.

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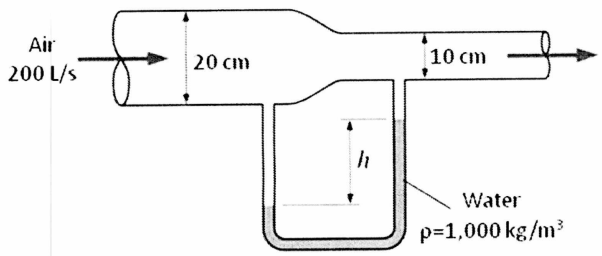
5. (10 points) Air flows through a pipe at a rate of 200 L/s. The pipe consists of two sections of diameters 20 cm and 10 cm with a smooth reduction section that connects them. The pressure difference between the two pipe sections is measured by a water manometer. Determine the difference height of water between the two pipe sections Take the air density to be 1.20 kg/m^3, and the kinetic energy correction factor to be 1.2.



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6. (10 points) In a hydroelectric power plant, fluid A is suppiled to the turbine at a rate of 0.3 m^3/min through a 200-km-long, 0.4-m-diameter cast iron pipe. The elevation difference between the free surface of the reservior and the turbine discharge is 115 m, and the combined turbine-generator efficiency is 85 percent. Disregard the minor lossess, determine the power output of this plant. Given properties: The density and dynamic viscosity of fluid A are ρ = 998 kg/m^3 and μ = 1.002×10^{-2} kg/m s.

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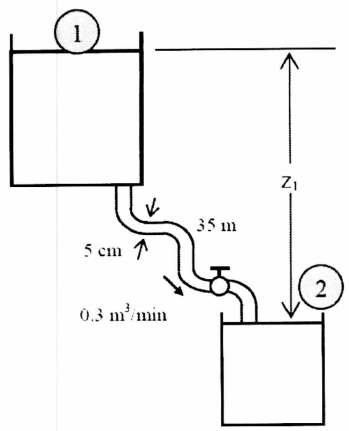
7. (15 points) Water at 20°C flows by gravity from a large reservoir at a high elevation to a smaller one through a 35-m-long, 5-cm-diameter cast iron piping system that includes three standard flanged elbows, a well-rounded entrance, a sharp-edged exit, and a fully open gate valve. Determine the elevation z_1 of the higher reservoir for a flow rate of 0.3 m^3/min. Given properties: The density and dynamic viscosity of water at 20°C are ρ = 998.0 kg/m^3 and μ = 1.002x10^{-3} kg/m·s. The roughness of cast iron pipe is ε = 0.26 mm. a well-rounded entrance (K_L = 0.03), a standard flanged elbow (K_L = 0.3), a fully open gate valve (K_L = 0.2), a sharp-edged exit (K_L = 1)



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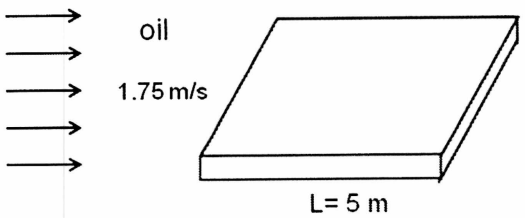
8. (10 points) Light oil at 20°C flows over a 5-m-long flat plate with a free-stream velocity of 1.75 m/s. Determine the total drag force per unit width of the plate.

Given properties: The density and kinematic viscosity of light oil at 20°C are ρ = 888.1 kg/m^3 and ν = 9.429 × 10^{-4} m^2/s.



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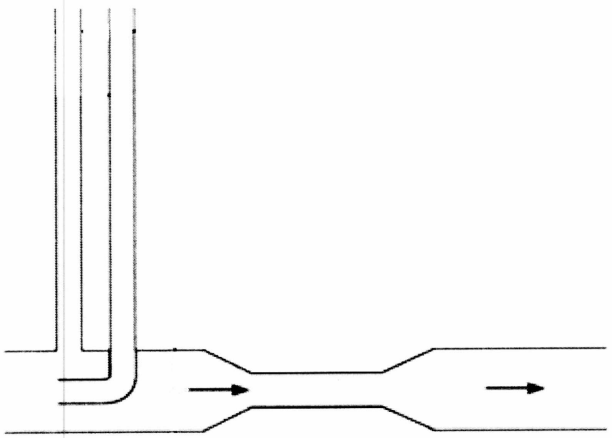
9. (5 points) Sketch HGL and EGL lines of these fluid flows as shown in the below figures. Assuming these flows are idealized Bernoulli-types.

9.1 (2.5 points)



9.2 (2.5 points)