Ministry of Higher Education Faculty of Engineering Kafrelsheikh University		وزارة التعليم العالي كلية الهندسة جامعة كفرالشيخ
Final Exam of Academic Year 2020 / 2021		
Department: Electrical Engineering	Year: 1st term of First year	Total Marks: 50
Course Title: Mechanical Power Engineering	Allowed Time: 3.0 Hours	Date: March 21, 2021

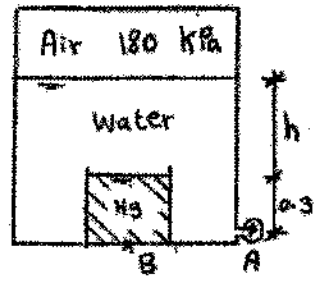
Answer the following questions with assuming any missing data.

Question No. 1:

The space between a square smooth flat plate (50 × 50) cm^2, and a smooth inclined plane (1:100) is filled with an oil film (S.G = 0.9) of 0.01 cm thickness (Fig. 1). Determine the kinematic viscosity in stokes if the plate is 2.3 kg. The velocity of the plate = 9 cm/sec.

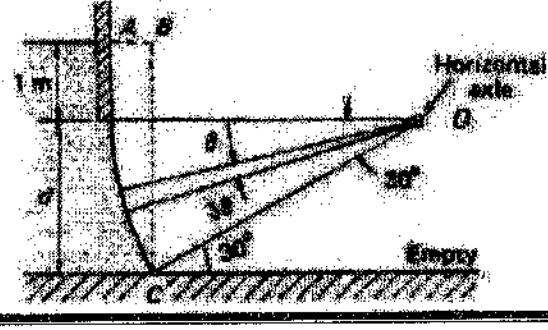
Question No. 2:

In the figure, P_B= 300 kPa. Calculate the level "h" and "P_A in kPa absolute". Dimensions in m.



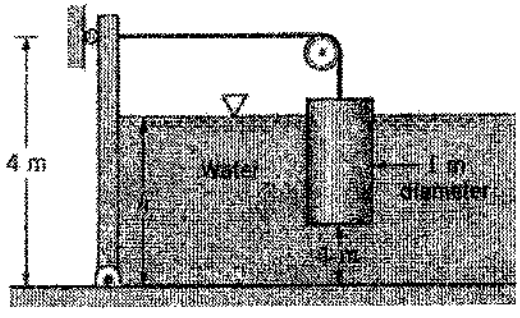
Question No. 3:

A sector gate, of radius 4 m and length 5m, controls the flow of water in a horizontal channel. For the (equilibrium) conditions shown in Figure below, determine the total thrust on the gate.



Question No. 4:

A 1-m-diameter cylindrical mass, M, is connected to a 2-m-wide rectangular gate as shown in figure below. Determine the required value for M if h = 2.5 m.

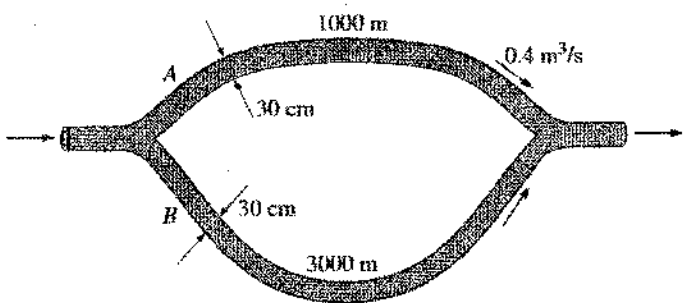


Question No. 5:

An oil of relative density of 0.9 flows through a vertical pipe of diameter 20 cm. The flow is measured by 20 cm × 10 cm venturi meter. The throat is 10 cm above the inlet. A differential U-tube mercury manometer is connected to throat and inlet. Let Cd = 0.99, calculate the flow rate for reading 9 cm. Then, calculate the reading for a flow of 50 L/s.

Question No. 6:

A certain part of cast iron piping of a water distribution system involves a parallel section. Both parallel pipes have a diameter of 30 cm, and the flow is fully turbulent. One of the branches (pipe A) is 1000 m long while the other branch (pipe B) is 3000 m long. If the flow rate through pipe A is 0.4 m^3/s, determine the flow rate through pipe B. Disregard minor losses and assume the water temperature to be 15°C. Show that the flow is fully turbulent, and thus the friction factor is independent of Reynolds number. (The density and dynamic viscosity of water at 15°C are $\rho = 999.1\ kg/m^3$ and $\mu = 1.138 \times 10^{-3}$ kg/m·s. The roughness of cast iron pipe is $\varepsilon = 0.00026\ m$.)



Question No. 7:

A Brayton cycle with regeneration using air as the working fluid has a pressure ratio of 7. The minimum and maximum temperatures in the cycle are 310 and 1150 K. Assuming an isentropic efficiency of 75 percent for the compressor and 82 percent for the turbine and an effectiveness of 65 percent for the regenerator, determine (a) the air temperature at the turbine exit, (b) the network output, and (c) the thermal efficiency.

Question No. 8:

Air is used as the working fluid in a simple ideal Brayton cycle that has a pressure ratio of 12, a compressor inlet temperature of 300 K, and a turbine inlet temperature of 1000 K. Determine the required mass flow rate of air for a net power output of 70 MW, assuming both the compressor and the turbine have an isentropic efficiency of (a) 100 percent and (b) 85 percent. Assume constant specific heats at room temperature.

Best wishes; ***Dr./ Fadl A. Essa***