Kaferelsheikh University
Faculty of Engineering
Department of Mechanical Engineering
Year: 2015-2016
2nd year MPE Bylaw2007

Subject: Fluid Mechanics
Date: 9/01/2016
Time allowed: 3hr
Full Mark: 60
Final Exam: 3 pages

Assume any missing data, state your assumption clearly

Answer all questions

Question: 1 [15 *Marks*]

(a) **Discuss briefly, the Newton's law of viscosity and it's important.** (5 *Marks*)

(b) **A viscous fluid (specific gravity, S = 1.26; kinematic viscosity, ($\nu = 1.189 \times 10^{-3}$ m^2/s) is contained between two large, horizontal parallel plates as shown in Figure. The fluid moves between the plates under the action of a pressure gradient B. When the lower plate is pulled with a velocity V while the upper plate is fixed, the velocity distribution for this flow takes the form**

$$u(y) = \frac{B}{2\mu}(y^2 - hy) + V\left(1 - \frac{y}{h}\right)$$

For V = 0.006 m/s, h = 2.54 cm, B = -53.0929 N/m^3, and the plate area A = 9.2903 m^2, determine (a) the shearing stress τ acting on the moving plate (y=0.0) and (b) the required force F and (c) power P to pull the plate. (ρ_w= 1000 Kg/m^3) (5 *Marks*)

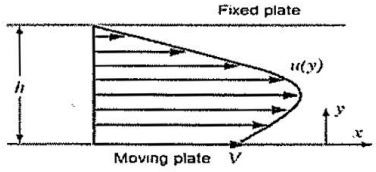


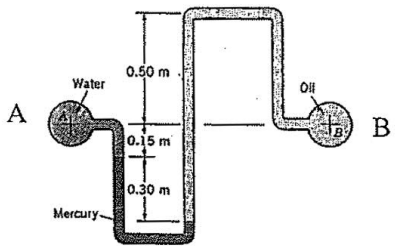
Figure 1

(c)Develop an expression for the liquid rise due to surface tension in two concentric cylinders. (5 *Marks*)

Question: 2 [15 Marks]

(a) **Explain the physical meaning of: Absolute pressure, vacuum pressure, pressure head, and vapour pressure, center of pressure force, total pressure force** *(5 Marks)*

(b) **The mercury manometer shown in figure indicates a differential reading of 0.30 m when the pressure in pipe A is 30 mm Hg vacuum. Determine the pressure in pipe B.** (5 *Marks)*



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(c)The 0.5-m-radius half-cylinder barrier in Figure is 8 m long into the paper and rests in static equilibrium against a wall. The contact between cylinder and wall is frictionless. Find (a) the horizontal force (magnitude F_H and location h_{cp}) and (b) vertical force (magnitude F_V) exerted on the curved surface of the barrier and (c) the barrier weight W. (Note: $\gamma = 9.80\ kN/m^3$). *(5 Marks)*

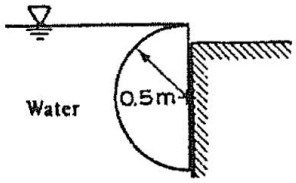

Figure 2

Question: 3 [15 marks]

(a) Define: Uniform and Non-uniform flows, laminar and turbulent flows, steady and unsteady? *(3 Marks)*

(b) Explain the different types of hydraulic energy for a steady flow. *(2 Marks)*

(c) Derive an equation expressing the actual discharge of water with installing a Venturi-meter a horizontal pipeline. *(5 Marks)*

(d) The loss of head, due to water flow, from entrance to throat of a (250 mm x 125 mm) venturi meter is (1/15) of its throat velocity head. A mercury differential gauge attached to the meter indicates a reading of 10 (cm). Determine: (i) the power loss due to flow from entrance to throat. (ii) The discharge coefficient and pipe Reynolds number. *(5 Marks)*

Question: 4 [15 Marks]

(a) What are losses in pipelines. Explain minor losses and major losses. *(5 Marks)*

(b) In the Fig. (4-b), shows a pipe line ABC which connects two reservoir having a constant level difference of 27 (m). If vapour pressure at running conditions is 0.2 (bar) and secondary losses are considered: (i)Determine the minimum pipeline diameter that can be used without vapour formulation in the line. (ii) Draw the TEL and H.G.L under the above condition. *(5 Marks)*

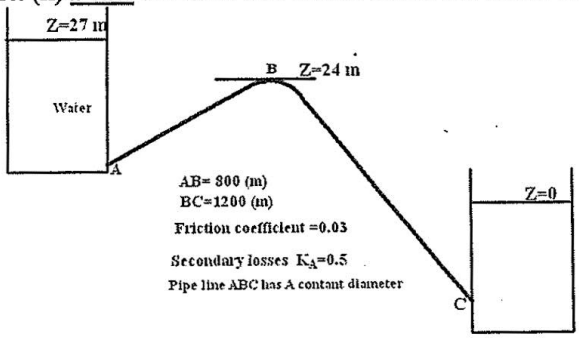

Fig.(4-b)

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(c) A system of pipes conveying water is connected in parallel and in series, as shown in Fig. (4-c) The section DE represents the resistance of a valve for controlling the flow, which has a resistance coefficient $K_{DE} = (4000/n)^2$, where n is the percentage valve opening. The Darcy friction factor f is 0.024 for all pipes, and their lengths and diameters are given by

Pipe	AA_1B	AA_2B	BC	CD	CF
Length (m)	30	30	60	15	30
Diameter (m)	0.1	0.125	0.15	0.1	0.1

The head at A is 100 m, at E is 40 m and at F is 60 m. If the valve is adjusted to give equal discharge rates at E and F, calculate the head at C, the total volume rate of flow through the system and the percentage valve opening. Neglect all losses except those due to friction. *(5 Marks)*

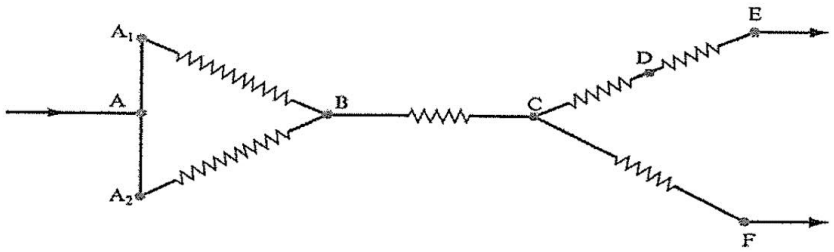

Fig. (4-c)

GOOD LUCK

Dr. Ismail Mohamed Sakr

Questions	*1*	*2*	*3*	*4*
ILO's	*A8,A13,B1*	*A8,B1,B2,B3,A13*	*A8,B3,C5*	*A8,C1,B1*