El-Mansoura University		**Hydraulics (I)**
Faculty of Engineering	**(2010-2011)**	**Final Term Exam.**
Irrigation and Hydraulics Dept.	**تخلفات**	**Time : 3hrs**

Answer the following questions:

Question (1):

(a). Define five fluid properties. Name their units and dimensions. **[5 Marks]**

(b). Determine the absolute viscosity of mercury in lb.sec/ft^2 if the viscosity in poises is 0.0158. **[5 Marks]**

(c). If a U-tube is made so that one limb is 2 cm in diameter and the other 2 mm in diameter and water is poured into the tube, what is the difference in level if the surface tension of water is 74 dynes/cm. If now mercury of surface tension 465 dynes/cm is used in the U-tube, what would be difference in level? The angle of contact of mercury with glass is 130^o. **[5 Marks]**

Question (2):

(a). A cylindrical tank contains water at a height of 55 mm, as shown in **Fig.(1)**. Inside is a smaller open cylindrical tank containing cleaning fluid (s.g = 0.80) at height h. If P_B=13.40 Kpa gage and P_C = 13.42 Kpa gage, what are gage pressure P_A and height h of cleaning fluid?. Assume that the cleaning fluid is prevented from moving to the top of the tank. **[5 Marks]**

(b). A cylinder made of wood (S.g = 0.6) and circular in cross section is required to float in oil (S.g = 0.9), if d = the diameter of the cylinder and L = height. Prove that L cannot exceed 0.75d for the cylinder to floating with its longitudinal axis vertical. **(Fig.2).** **[5 Marks]**

(c). If the expression for the stream function is described by:

$$\Psi = x^3 - 3xy^2,$$

determine whether the flow is:

i) rotational ii) irrotational

If the flow irrotational, then indicate the correct Value of the velocity potential :

(a) $\phi = y^3 - 3x^2y$ **(b)** $\phi = -3x^2y$ **[10 Marks]**

Question (3):

(a). A venturi-meter has its axis vertical (fig.(3)), the inlet and throat diameters being 150 mm and 75 mm respectively. The throat is 225 mm above the inlet. Oil of specific gravity 0.78 flows through the meter at the rate of 0.0396 m^3/min of water. Find :

1) The pressure difference between inlet and throat in kg/cm^2.

2) The difference in level which would be registered by a vertical mercury U-gauge connected to the inlet and to throat (s.g of mercury = 13.60). Neglect all losses. **[8 Marks].**

(b). Show that the discharge over a sharp-edged V-notch is theoretically proportional to the head raised to 2.50 ($\theta = 90^o$ and $C_d = 0.60$).

A sharp-edged-V-notch inserted in the side of a rectangular tank 10 ft long and 6 ft broad. Find how long it will take to reduce the head in the tank from 8 in. to 4 in. if the water discharges freely over the notch and there is no inflow into the tank. **[8 Marks]**

(c). Water flows ate a rate of 0.5m^3/s rising through a 50, contracting pipe bend. The diameter at the bend entrance is 0.70m and 0.50m at the exit - as shown in the following Figure . If the pressure at the entrance to the bend is 200 kN/m^2, determine the magnitude and direction of the force exerted by the fluid on the bend. (The exit of the bend is 0.4m higher than the entrance and the bend has a volume of 0.2m^3). Comment on the reason why frictional losses may be neglected in this analysis. **(Fig.4).** **[8 Marks]**

Question (4):

(a). A ship 650 ft long is to operate at a speed 22 mph in ocean water whose kinematic viscosity is 0.00001261 ft2/s. What should be the kinematic viscosity of a fluid used with an 11 ft model. **[8 Marks]**

(b). Two sharp ends pipes of diameters 50 mm and 100 mm respectively, each of length 100 m are connected in parallel between two reservoirs which have a difference of level of 10 m. If the coefficient of friction for each pipe is $\lambda = 0.32$, calculate the rate of flow for each pipe and also the diameter of a single pipe 100 m long which would give the same discharge, if it were substituted for the original two pipes. **(Fig.5)**. **[7 Marks]**

(c).If the flows into and out of a two-loop pipe system are as shown in **Figure (6)**. Determine the flow in each pipe. **[8 Marks].**

(d).Two reservoirs , having difference in water as 12 meters are connected by a pipe line 3 km long and 30 cm diameter. Find the discharge through the pipe. If the last 1.50 km of the pipe is replaced by two pipes of 1.50km long and 30 cm diameter each, determine the increase in the discharge. (take $\lambda = 0.01$). **(Fig. 7).** **[8 Marks]**

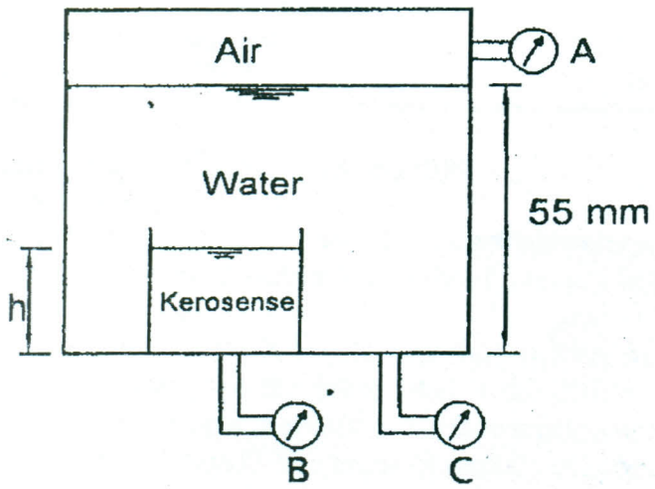

Fig.(1)

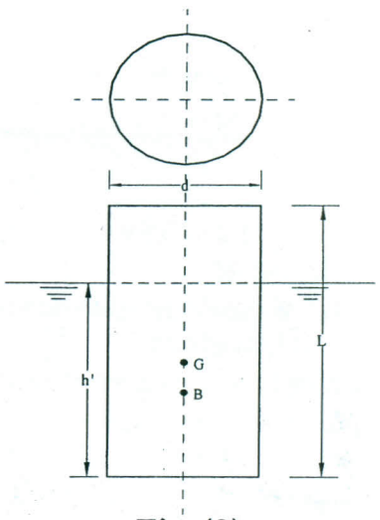

Fig.(2)

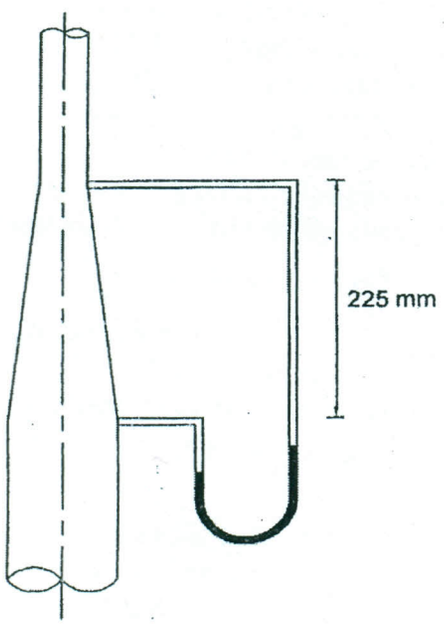

Fig.(3)

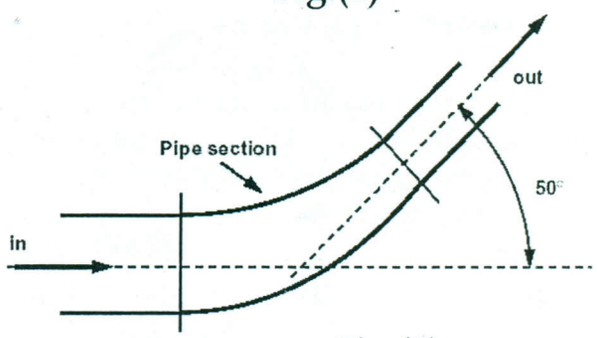

Fig.(4)

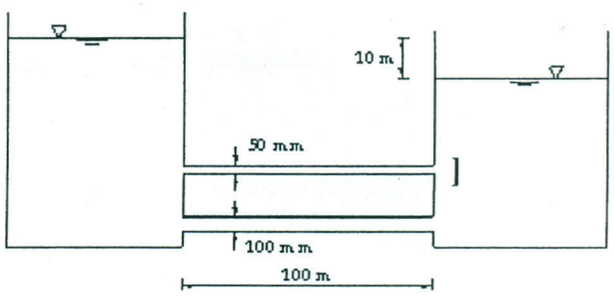

Fig.(5)

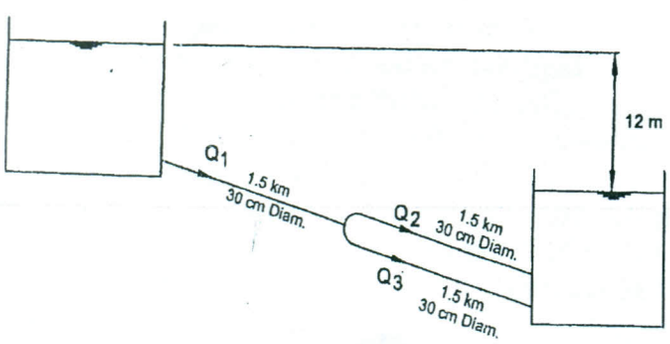

Fig.(7)

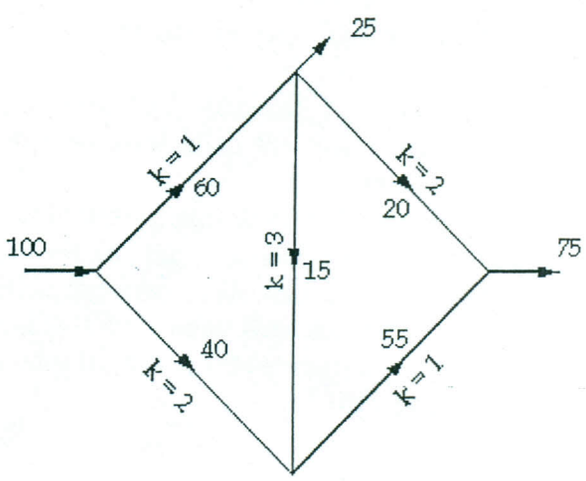

Fig.(6)