Menoufiya University		Postgraduate: Master
Faculty of Engineering,		Subject: : Pump Station Engineering
Shebin El-Kom		Code No.: CVE 638
Dep.: Civil Engineering Department		Date: 19/08/2020
Semester: Second		Time Allowed: 3.0 hrs.
Academic year: 2019-2020	Minufiya University	Total marks: 100

Solve the following questions, any missing data can be reasonably assumed, and follow steps of solution using neat sketches.

Question (1) .... (20 marks)

A) Mention the main advantages and disadvantages of external gear pumps.   (5 marks)

B) What is the main classification of pumps?   (5 marks)

C) Discuss with neat sketches the different types of casings for centrifugal pumps.   (5 marks)

D) A pump having an operating water power of 10 Kw and an operating pump efficiency of 80% .

Calculate the input electrical power if an electrical motor in conjunction with a V- belt drive the pump. Knowing that the transmission efficiency is 93 % and the motor efficiency is 90 %, calculate the cost of electrical energy in a month if the pump operates for 8 hours daily for 30 days. Assuming that the cost of the electrical energy is 100 LL/kW.   (5 marks)

Question (2) .... (25 marks)

A) Define the different efficiency components.   (5 marks)

B) What are the advantages and disadvantages of peristaltic pumps?   (5 marks)

C) Differentiate between the centrifugal and reciprocating pumps.   (5 marks)

D) Water at ordinary temperature is pumped at the rate of 900 liters/min (operating discharge). The pumping set-up shown below has a suction diameter pipe of 6 in commercial steel pipe and 15 m long. The discharge pipe has a 4-in diameter and a length of 200 m made of commercial steel pipe. Assume that the entrance of the low-level reservoir is through a square-edged inlet and that the elbows are standard. The valves are full open gate valves .
(10 marks)

1- Calculate the head losses in the suction pipe using the K factor method .

2- Calculate the head losses in the discharge pipe using the equivalent length method .

3- Calculate the total head loss & the head required from the pump .

4- Draw the pipe resistance curve in function of the discharge Q. Take $v = 1.15 \times 10^{-6}$ m^2/s
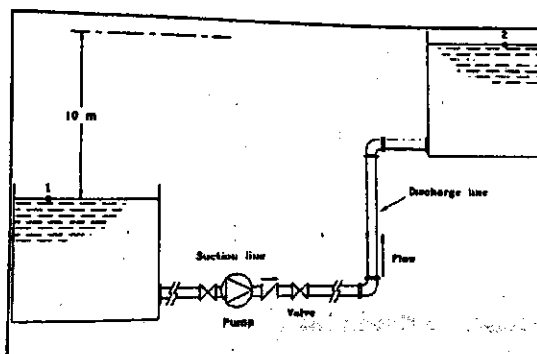
Question (3) .... **(30 marks)**

A) Why are pumps combined on parallel or in series? (5 marks)

B) Show the effect of shaft speed on the pump characteristics. (5 marks)

C) What are the remarks that should be considered to avoid air bubbles? (5 marks)

D) A pump delivered 0.0125 m³/s against a heat of 32 m at an: efficiency of 50 % and a constant speed using a 5 in diameter.

Determine the pump new characteristics if a 6 in impeller is used at the same speed. Find the new diameter if the required operating point has h = 39 m. (7 marks)

E) Suppose a single stage centrifugal pump delivers 0.3 m³/s against a head of 30 m at a speed of 1500 rpm at its normal operation point. If it is required to deliver 0.4 m³/s at a head of 105 m by using a similar pump operating at the same speed but with multistage in series. How many stages are required? (8 marks)

Question (4) .... **(25 marks)**

A) What are the items which must be specified after the pump specification? (5 marks)

B) How to avoid that the pump is operated at zero capacity? (5 marks)

C) Define cavitation and how the cavity can be formed. (5 marks)

D) A submersible pump is used to deliver 80 gpm of water through a vertical lift of 45 m. The inlet to the pump is just below the water surface and the discharge is to the Booster-pressure tank through a commercial steel pipe. Assume that two long radius elbows, one gate valve and one check valve are connected to the discharge pipe. The unit head loss due to pipe friction is taken as 7 ft / 100 ft. Other losses are neglected.

1- Determine the necessary pipe diameter, the flow velocity and the corresponding friction factor.

2- Calculate the power delivered by the pump to the water if the required pressure in the pressure tank is 40 Psi. The mechanical efficiency of the pump is 0.82. Find the B.hp.

3- Calculate the power delivered by the pump to the water if the roof tank is connected directly to the pump. The additional height is 20 m. Assume the same number of fittings.

(10 marks)

With our best wishes
Prof. Mohamed Sob