MEMORIAL UNIVERSITY OF NEWFOUNDLAND

FACULTY OF ENGINEERING AND APPLIED SCIENCE

ENGINEERING 4913 FLUID MECHANICS I

Date: Monday 30 July 2007 Instructor
Time: 2:00pm to 5:00pm M. Hinchey

A) Write brief notes on each of the following: (1) Conservation Laws for Fluid Flow (2) Air Flow Measurement Techniques (3) Pressure Iteration Method for Pipe Networks (4) Selection of Turbomachines (5) Classification of Fluid Flows. [THIS QUESTION IS WORTH 15%: EACH QUESTION PART IS WORTH 3%]

B) A certain GBS has an open tube geometry. Its outer radius is 40m while its inner radius is 20m. It is submerged 40m. The center of gravity of the rig is at the water line. Is the rig stable? Note that the wedge shaped volume moment for a solid cylinder with radius R is $K\theta$ where $K=\pi R^4/4$. [THIS QUESTION IS WORTH 12%]

C) Say you installed a Pelton Wheel Turbine in your basement that can run on city water. Let the bucket radius of the device be 0.25m: let the jet pressure be 500kPa and the flow rate be 2 L/s. Derive an equation for the power output of the device. What is the peak power of the device? At what RPM does the power output peak? [THIS QUESTION IS WORTH 21%: EACH QUESTION PART IS WORTH 7%]

D) A water bomber uses a pipe to pick up a load of water as it flies at a constant speed over the surface of a lake. The diameter of the pipe is 0.25m and the speed of the bomber is 100 km/hr. Calculate the load on the bomber as it picks up water. How much power does the bomber supply to counteract this load? How long would it take the bomber to pick up a $10m^3$ load of water? [THIS QUESTION IS WORTH 21%: EACH QUESTION PART IS WORTH 7%]

E) A siphon is used to draw water from a small pond 20m above a cabin in the woods. The overall length of the siphon is 100m and its diameter is 2.5cm. What would be the flow rate through the siphon? Derive the system demand equation. Determine the flow rate when a 20m head pump is added to the system. What type of pump is appropriate for this system? Could cavitation occur in the system? [THIS QUESTION IS WORTH 25%: EACH QUESTION PART IS WORTH 5%]

F) A water spider is a small insect that can walk on water. What scaling parameters would be important for construction of a mechanical model of the spider? [THIS QUESTION IS WORTH 6%]