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Total number of printed pages – 2

B. Tech
PCCH 4201

Third Semester Examination – 2012-13

FLUID FLOW AND FLOW MEASUREMENT

Full Marks – 70

Time : 3 Hours

*Answer Question No. 1 which is compulsory and any **five** from the rest.*

The figures in the right-hand margin indicate marks.

1. Answer the following questions : 2×10
- (a) Write the barometric equation and explain the terms used.
 - (b) Estimate the atmospheric pressure at the summit of Mount Everest which is 8848 m above sea level. Assume an average temperature of 0°C.
 - (c) What are dilatant and rheopectic fluids ? Give one examples of each.
 - (d) Discuss the viscosity behaviour of gases and liquids with the change in temperature.
 - (e) What is transition length ?
 - (f) What is kinetic energy correction factor ? Why it is used ?
 - (g) Differentiate between skin friction and form friction.
 - (h) Define Mach number and mention its significance.
 - (i) What is creeping flow ?
 - (j) What is cavitation ?
2. (a) A submarine is designed to operate 4 KM below the sea surface. If the interior pressure is 1.1 atm, what is the total pressure on a 20 cm diameter window ? The average density of seawater is 1030 kg/m³. 5
- (b) Crude oil is pumped at 1.5 m/s through a pipeline 1 m in diameter. Above what value of the oil viscosity would laminar flow exist ? Give your answer in SI units. 5

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3. (a) Discuss with a neat sketch the development of turbulent boundary layer on a flat plate. 4
- (b) A water tank is 30 m in diameter and 25 m in height. The outlet is a 10 cm horizontal pipe at the bottom side. If the pipe is removed from the tank, what will be the initial rate of water from the tank ? Neglect friction losses. Also calculate the time for the tank to be empty. 6
4. Derive the Bernoulli equation without friction with a suitable diagram. 10
5. (a) Briefly discuss about the operation of a pitot tube. 4
- (b) A horizontal venturi meter having a throat diameter of 20 mm is set in a 75 mm ID pipe line. Water at 15°C is flowing through the line. A manometer containing mercury under water measures the pressure differential over the instrument. When the manometer reading is 500 mm, calculate the flow rate in m³/h. 6
6. Prove that the average velocity is precisely one-half the maximum velocity for laminar flow of Newtonian fluids in pipes. 10
7. (a) Discuss in detail the mechanism of fluidization. With a suitable plot explain the variation of pressure drop and bed height w.r.t. the superficial velocity. 6
- (b) Why the centrifugal pump needs primming ? 2
- (c) What is slip of reciprocating pump ? 2
8. Write short notes on any **two** : 5×2
- (a) Boundary layer separation and wake formation
- (b) Hagen-Poiseuille equation
- (c) Net positive suction head
- (d) Characteristic curves of centrifugal pumps.