Registration No. : | | | | | | | | | | |

Total number of printed pages – 2

B. Tech

CPCH 7202

Special Examination – 2012

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.

Assume suitable notations and any missing data wherever necessary.

1. Answer the following questions : 2×10

(a) What are compressible and incompressible fluids ?

(b) Discuss the effect of temperature on the viscosity of liquids and gases.

(c) Write and explain the Newton's law of viscosity.

(d) Draw the plot of shear stress vs. velocity gradient for Newtonian and non-Newtonian fluids with examples.

(e) Define the equation of continuity.

(f) Write and explain the Bernoulli's equation.

(g) Write the Reynolds equation and mention its significance.

(h) Name the device used to measure the local or point velocity.

(i) Name the pump commonly employed in industry for handling high viscosity liquids.

(j) Write the advantages and disadvantages of fluidization.

2. (a) Check the dimensional homogeneity of the following equation and comment.

$$h_i = 0.023\ G^{0.8}\ k^{0.67}\ c_p^{\ 0.33}\ D^{-0.2}\ \mu^{-0.2}$$

where, h_i = heat transfer coefficient, G = mass velocity, k = thermal conductivity, c_p = specific heat, D = diameter, and μ = viscosity. 5

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(b) Define and derive the barometric equation. 5

3. (a) Water of density 1005 kg/m^3 and viscosity 0.0008 N.s/m^2 is pumped at 990 cm^3/s through a 24 mm ID pipe. Calculate the value of Reynolds number. 4

(b) A fluid is flowing through a 6 cm diameter pipe at a velocity of 2.5 m/s. Suddenly it enters into the larger cross-sectional part of the pipe having a diameter of 12 cm. Calculate the frictional loss due to sudden expansion of flow area. 6

4. (a) Draw a neat sketch of venturi meter and explain its construction. 5

(b) Derive the flow equation for venturi meter. 5

5. Crude oil of density 850 kg/m^3 is pumped at a rate of 5 l/s through 500 m of steel pipe under a pressure drop of 560 kPa. Calculate the Fanning friction factor if the pipe diameter is 50 mm, using Hagen-Poiseulli equation. 10

6. (a) Differentiate between centrifugal and reciprocating pumps. 5

(b) Briefly explain the characteristic curves of centrifugal pump. 5

7. A liquid of density 1200 kg/m^3 is flowing from a point A to point B which is 6 m above point A. The frictional losses in a pipeline of 50 mm ID are 2 J/kg for a volumetric flow rate of 500 cm^3/s. If point A and B are at atmospheric pressure and velocity at point A is zero, using Bernoulli equation, calculate the pump work done. 10

8. Write short notes on any **two** : 5×2

(a) Orifice meter

(b) Variable area meter

(c) Reciprocating pump

(d) Fluidization