Code: 9A14403

R09

B.Tech II Year II Semester (R09) Supplementary Examinations December/January 2015/2016

FLUID MECHANICS & HEAT TRANSFER

(Mechatronics)

Time: 3 hours Max. Marks: 70

All questions carry equal marks

A total of five questions are to be answered with at least two questions from each part

Use of heat transfer data books is permitted in the examination hall

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PART - A

1 (a) What is the pressure within a droplet of water 0.05 mm in diameter at 20℃, if the pressure outside the droplet is standard atmospheric pressure of 1.03 N/cm^2. Take $\sigma = 0.0075\ N/m$ for water at 20℃.

(b) Explain manometers in brief.

2 (a) The velocity components in a two dimensional flow field for an incompressible fluid are expressed as $u = \frac{y^3}{3} + 2x - x^2y$ & $v = xy^2 - 2y - \frac{x^3}{3}$. Show that these functions represent a possible case of an irrotational flow.

(b) Explain the formation of boundary layer along a thin flat plate.

3 Derive the expressions for shear stress and velocity for a steady laminar flow in circular pipes from the basics. Also draw the variation of shear stress and velocity in the form of a sketch.

4 A Pelton wheel has to be designed for the following data. Power to be developed = 6000 kW. Net head available = 300 m, speed = 550 rpm, ratio of jet diameter to wheel diameter = 1/10 and overall efficiency = 85%. Find the number of jets, diameter of the jet, diameter of the wheel and the quantity of water required.

PART - B

5 (a) Develop equation for heat flow in a cylindrical body.

(b) The wall of a cold storage consists of three layers – an outer layer of ordinary bricks, 25 cm thick, a middle layer of cork, 10 cm thick, and an inner layer of cement 6 cm thick. The thermal conductivities of the materials are brick 0.7, cork 0.043 and cement 0.72, in W/m℃. The temperature of the outer surface of the wall is 30℃, and that of the inner is -15℃. Calculate steady state rate of heat gain per unit area of the wall, the temperatures at the interfaces of the composite wall.

6 (a) Discuss the important dimensionless groups in corrective heat transfer.

(b) Discuss the boundary layer concept with the help of schematic diagram.

7 (a) Derive the equation for finding net radiation between two block surfaces.

(b) Radiant energy with an intensity of 700 W/m^2 strikes a flat plate normally. The absorptivity is twice the transmittivity and 2.9 times its reflectivity. Determine the rate of absorption, transmission, and reflection of energy in W/m^2.

8 (a) Explain how overall heat transfer coefficient is constructed from individual coefficients.

(b) What are fouling factors? What do they account for?

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