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Roll No. to be filled in your Answer Book

Roll No. | | | | | | | | | | |

Semester: III

B. Tech End Semester Examination Dec 2014

FLUID MECHANICS

Time: 3 Hours **MM. 100**

Note: Attempt all questions. All questions carry equal marks. Assume missing data suitably.

Q.1 Attempt any four of the following. (5x4=20)

(a) Why does the viscosity of a gas increases with the increase in temperature while that of liquid decreases with increase in temperature.

(b) The following case represents the two velocity components; determine the third component of velocity such that they satisfy the continuity equation.
$u = x^2 + y^2 + z^2 \; ; v = xy^2 - yz^2 + xy$

(c) The stream function for a two dimensional flow is given by $\varphi = 2xy$, calculate the velocity at the point P (2, 3). Find the velocity potential function ϕ.

(d) With neat sketches, explain the conditions of equilibrium for floating and submerged bodies.

(e) Distinguish between:
$(i) Steady\ flow\ and\ Un-steady\ flow$
$(ii) Uniform\ and\ Non-uniform\ flow$

(f) What do you mean by repeating variables? How are the repeating variables selected for dimensional analysis?

Q.4 Attempt any two of the following. **(10x2=20)**

(a) What do you mean by Prandtl mixing length theory? Find an expression for shear stress due to Prandtl.

(b) Show that velocity distribution for turbulent flow through rough pipe is given by

$$\frac{u}{u_*} = 5.75 \log_{10}\left(\frac{y}{k}\right) + 8.5$$

(c) Define the terms:
(i) Boundary Layer (ii) Boundary Layer Thickness
(iii) Energy Thickness (iv) Momentum Thickness

Q.5 Attempt any two of the following. **(10x2=20)**

(a) Find the displacement thickness, the momentum thickness and energy thickness for the velocity distribution in the boundary layer given by

$$\frac{u}{U} = 2\left(\frac{y}{\delta}\right) - \left(\frac{y}{\delta}\right)^2$$

(b) (i) How are drag and lift forces caused on a body immersed in a moving fluid ?
(ii) What is the drag force on a sphere in the stoke range?

(c) A man weighing 90 kgf descends to the ground from an aeroplane with the help of a parachute against a resistance of air. The velocity with which the parachute, which is hemispherical in shape, comes down is 20 m/s. Find the diameter of the parachute. Assume $C_D = 0.5$ and density of air 1.25 Kg/m^3.