Roll No. .....

2110

B. E. (4th Sem.) (Mech Engg.) Examination – December, 2011

FLUID MECHANICS

Paper : ME-208-E

Time : Three hours] *[Maximum Marks : 100*

Before answering the question, candidates should ensure that they have been supplied the correct and complete question paper. No complaint in this regard, will be entertained after examination.

Note : Attempt any *five* questions.

1. (a) Derive relation for metacentric height of a floating body. 10

(b) A circular plate 3.0 m diameter is immersed in water in such a way that the plane of the plate makes an angle of 60° with the free surface of water. Determine the total pressure and position of centre of pressure when upper edge of the plate is 2m below the free surface water surface. 10

2. (a) Derive differential equation of continuity in polar coordinates with assumptions made. 12

(b) Explain rotation and derive the relation for the same. 8

3. (a) Derive kinetic and momentum correction factors. 8

(b) The maximum flow through a 300 mm diameter horizontal pipe line is 18200 liter/minute. A venturimeter is introduced at a point of the pipe line where the pressure head is 4.6 m of water. Find the smallest diameter of throat so that pressure at the throat is never negative. Assume coefficient of meter as unity. 12

4. A uniform flow with a velocity of 20 m/s is flowing over a source of strength 10 m^2/s. The uniform flow and source flow are in the same plane. Obtain the equation of the dividing stream line and sketch the flow pattern. 20

5. (a) Derive expression for Displacement thickness and Momentum thickness related to boundary layer. 10

(b) Derive relation for drag force on a flat plate due to boundary layer. 10

6. (a) What is hagen poiseuille's Formula ? Derive the expression for the same. 12

(b) Show that value of the coefficient of friction for viscous flow through a circular pipe is given by : 8

$$f = 16 / R_e$$

Where Re is Reynolds number.

7. (a) Three reservoirs A, B and C are connected by a pipe system having length 700 m. 1200 m and 500 m and diameters 400 mm, 300 mm and 200 mm respectively. The water levels in reservoir A and B from a datum line are 50 m and 45 m respectively. The level of water in reservoir C is below the level of water in reservoir B. Find the discharge into or from the reservoirs B and C if the rate of flow from the reservoir A is 150 liters per sec. Find the height a water level in the reservoir C. Take f = 0.005 for all the pipes. 12

(b) How will you determine head loss due to friction in pipe by using Darcy weisbach formula ? 8

8. (a) What do you mean by Prandtl mixing length theory ? Find an expression for shear stress due to prandtl. 10

(b) Determine the distance from the center of the pipe, at which the local velocity is equal to the average velocity for turbulent flow in pipes. 10