2110

B.E. 4th Semester (Mech. Engg.) Examination,

December–2010

FLUID MECHANICS

Paper - ME-208-E

Time allowed : 3 hours] *[Maximum marks :100*

***Note :** Attempt any **five** questions. All questions carry equal marks.*

1. (a) Derive expression for total pressure and center of pressure for a vertically immersed surface. 10

(b) A hollow wooden cylinder of sp. gr. 0.56 has an outer diameter of 600 mm and an inner diameter of 300 mm. It is required to float in oil of sp. gr. 0.85, calculate :

(i) The maximum length/height of the cylinder so that it shall be stable when floating with its axis vertical.

(ii) The depth to which it will sink. 10

2. (a) Derive the continuity equation in polar coordinates. Also list the various assumption made. 10

(b) If the velocity field is given by $u = x^2 + 2xy$ and $v = -(y^2 + 2xy)$, determine the circulation around a closed curve defined by x=1, x=3, y=1, y=4. 10

3. (a) Describe an orifice meter and find an expression for measuring discharge of fluid through a pipe with this device. 10

(b) A 45^0 reducing bend is connected in pipe line, the diameter at the inlet and outlet of the bend being 400 mm and 200 mm respectively, find the force exerted by water on the bend if the intensity of pressure at inlet of the bend is 215.8 kN/m^2. The rate of flow of water is $0.5m^3/s$. 10

4. (a) Sketch the flow pattern of an ideal fluid flow past a cylinder with circulation. 10

(b) A point source is a point where an incompressible fluid is imagined to be created and sent out evenly in all directions. Determine its velocity potential and stream function. 10

5. (a) Find an expression for the power absorbed in overcoming viscous resistance in case of a collar bearing. 10

(b) The fixed parallel plates kept at 80 mm apart have laminar flow of oil between them with a maximum velocity 1.5m/s taking dynamic viscisity of oil to be 19.62 poise, calculate :

(i) The discharge per m width.

(ii) The shear stress at the plates.

(iii) The pressure difference between two points 25 m apart.

(iv) The velocity at 20 mm from the plate.

(v) Velocity gradient at the plates end. 10

6. (a) Derive expression for power transmission through the pipes. Find also the condition for maximum power transmission. 10

(b) A pipe line of 0.6 m diameter is 1.5 km long. To augment the discharge, another pipe line of the same diameter is introduced parallel to the first in the second half of its length. Find the increase in discharge if the friction factor is 0.04 and head at the inlet is 30m. 10

7. (a) Why is it necessary to control the growth of boundary layer on most of the bodies ? What methods are used for such a control? 10

(b) A submarine can be assumed to have cylindrical shape with rounded nose. Assuming its length to be 55m and diameter, 6.0m, determine the total power required to overcome boundary friction if it cruises at 8.0 m/s velocity in water at 20^0C. 10

8. (a) Derive an expression for shear stress on the basis of Prandtl's mixing length theory. 10

(b) A 300mm diameter pipe is carrying water if the velocity at the pipe center and at a point 100mm from the pipe center are respectively 3m/s and 2.5m/s, determine the wall shearing stress. Assume the flow to be turbulent. 10