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AU/CE/IP/ME - 405

B.E. IV Semester

Examination, December 2013

Fluid Mechanics

Time : Three Hours

Maximum Marks : 70

Note: Attempt all questions. All questions carry equal marks. Assume suitable data if needed.

1. a) Explain briefly the following mechanical gauges. 6

   i) Bourdon pressure gauge

   ii) Diaphragm gauge

   b) An open cylindrical vertical container is filled with water to a height of 30cm above the bottom and user that an oil of specific gravity 0.82 for another 40cm. The oil does not mix with water. If the atmospheric pressure at that location is 1 bar, determine the absolute and gauge pressure at the oil water interface and at the bottom of cylinder. 8

OR

2. a) Define the following: 6

   i) Centre of pressure

   ii) Centre of Buoyancy

   iii) Metacenter

   b) A trapezoidal channel 2m wide at bottom and 1.5m deep has side slope 1:1. Determine 8

   i) Total pressure

   ii) Center of pressure on vertical gate closing the channel when it is full of water

3. a) Define - circulation, vorticity, convective and local acceleration. 6

   b) Check whether the following flows are steady and irrotational

   i) $u = 4y \quad , \quad v = -6y$

   ii) $u = 6xy \ , \ v = 0$

   iii) $u = -4x \ , \ v = 4y$ 8

OR

4. a) State and prove the continuing equation for incompressible three dimensional flow. rgpvonline.com 6

   b) If the velocity field is given by $u = 16y - 8x$, $v = 8y - 7x$, find the circulation around the closed curve defined by $x = 4, y = 2, x = 8, y = 8$. 8

5. a) Describe a orifice meter and find an expression for measuring discharge of fluid through a pipe with this device. 6

   b) A 20cm×10cm venturimeter is provided in a vertical pipe carrying water flowing in the up ward direction. A differential mercury manometer connected to the inlet and throat gives a reading of 200mm. Find the rate of flow. Assume $C_d = 0.98$. 8

OR

6. a) How the notches and weirs are classified. 6

   b) The head lost in flow through a 50 mm diameter orifice under a certain head is 160 mm of water and the velocity of water in the jet is 7.0 m/sec. If the coefficient of discharge be 0.61 determine: 8

      i) Head on the orifice causing flow

      ii) The coefficient of velocity

      iii) The diameter of jet.

7. a) Explain the different types of similarities. 6

   b) Explain the different dimensionless numbers with their significance for fluid flow problems. 8

OR

8. An object like torpedo 900 mm diameter is to move in air at 60m/sec and its drag is to be estimated from tests in water on a half scale model. Determine the necessary speed of the model and the drag of the full scale object of that of model is 1140 N. Assuming.

   Air viscosity=1.86×10^{-5}Ns/m^2, Water viscosity =1.01×10^{-3} Ns/m^2

   Air density = 1.2 kg/m^3, water density = 1000 kg/m^3. 14

9. a) Explain the Reynolds apparatus with the help of neat sketch. 6

   b) An oil of dynamic viscosity 20 centipoise, and density of 1200kg/m^3 flows through a 250m long 25 mm dia pipe.

      i) Calculate the maximum flow in m^3/sec that will ensure laminar flow.

      ii) What would be the pressure drop for this flow. 8

OR

10. Derive an expression for Hagen poiseuille equation and state the assumptions mode. 14

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