



UNIVERSITY OF RUHUNA

Faculty of Engineering

Mid-Semester 3 Examination in Engineering: June 2014

Module Number: ME3307

Module Name: Fluid Mechanics

[Two Hours]

[Answer all questions, each question carries five marks]

Q1 a) Explain following flow types by giving suitable examples;

- i) Steady uniform flow
- ii) Steady non-uniform flow
- iii) Unsteady non-uniform flow.

[1 Mark]

b) In a two-dimensional, incompressible flow the fluid velocity components are given by $v_x = x - 4y$ and $v_y = -y - 4x$. Show that the flow satisfies the continuity equation and obtain the expression for the stream function. If the flow is potential obtain also the expression for the velocity potential.

[4 Marks]

Q2 a) Explain boundary layer development over a thin flat plate placed in a uniform flow.

[1Mark]

b) Estimate the power needed to overcome the drag force due to the skin friction on a large barge which has a flat-bottom of length 20 m and width 5 m. It is towing on a still canal at a speed of 5 km/hr. Neglect pressure drag due to the front surface and take dynamic viscosity and density of canal water as 1.14×10^{-3} kg/ms and 1000 kg/m³, respectively.

[4 Marks]

Q3 a) State Buckingham- π theorem.

[1 Mark]

b) At a sudden contraction in a pipe the diameter changes from D_1 and D_2 . The pressure drop, Δp , which develops across the contraction is a function of D_1 and

D_2 , as well as the velocity, V , in the large pipe, and the fluid density, ρ , and viscosity, μ . Use D_1 , V , and μ as repeating variables to determine a suitable set of dimensionless parameters. Why would it be incorrect to include the velocity in the smaller pipe as an additional variable?

[4 Marks]

Q4 a) Explain different classification methods of fluid machinery.

[1 Marks]

b) What are the differences between Turbomachines and Positive Displacement Machines (PDMs)?

[2 Marks]

c) Explain with neat sketches three different types of Turbomachines.

[2 Marks]