THE OPEN UNIVERSITY OF SRI LANKA

B.Sc. Degree Programme

APPLIED MATHEMATICS-LEVEL 05

ADU5306- FLUID MECHANICS

NO BOOK TEST 2017/2018

Duration: One Hour

Date:-02.02.2019 Time:- **1:00p.m.-2:00p.m.**

Answer **all** questions and also **note that** *standard notation is used throughout the paper.*

1. (a) A fluid is in equilibrium under the external force per unit mass $\underline{F}$ on a flat plate.
   i. Show that $\underline{F}.dr = \frac{dp}{\rho}$
   ii. If the external forces acting on the fluid is gravitational force only, then show that $-\rho g dz = dp$
   iii. Furthernore, if $\rho = exp(-z)$, then show that $p = p_0 - g(1 - e^{-z})$ where p_0 is the pressure acting on the free space.

   (b) Suppose a motion of an incompressible homogeneous fluid under no force is steady. The velocity at any point is given by $by\mathbf{i} + ay\mathbf{j} - 2az\mathbf{k}$, where a is a constant. Find the surface of equal pressure.

2. (a) Let $\Omega(z) = z^2, z \in \mathbb{C}$, find the streamlines and equipotential lines.

   (b) Consider the complex potential given by $\Omega(z) = z + \frac{1}{z}$. Find the stream function and the potential function.

   (c) Consider the potential function given by $\phi = x^2 - y^2 + e^x cosy$. Find the stream function and the complex velocity potential.

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