

The Open University of Sri Lanka
 B.Sc/B.Ed Degree Programme
 Closed Book Test (CBT) 2010/2011
 Level 05-Applied Mathematics
 AMU 3181/AME 5181 – Fluid Mechanics



Duration :- One and half hours.

Date :- 28-04-2011.

Time:- 4.00 p.m. – 5.30 p.m.

Answer All Questions.

1. (i). Write down the dimensions of the following quantities.

(a) Resistance	(b) Length	(c) Density
(d) Velocity	(e) Viscosity	(f) Elasticity
- (ii) The resistance R , of a supersonic plane during motion depends upon the length L , Velocity V , air density ρ , air viscosity μ and the bulk modulus of elasticity κ , Show that using Buckingham's π -theorem that the relationship between the resistance R , and the other variables given by,

$$R = \rho L^2 V^2 \phi \left(\frac{\mu}{\rho L}, \frac{\kappa}{\rho V^2} \right).$$

2. A two-dimensional source and a sink of equal strength m are placed at points $A(a,0)$ and $B(-a,0)$ respectively, in an infinite fluid which is otherwise at rest. Write down the stream function ψ at any point P . Hence show that the x -axis is a stream line.

Find the velocity potential at point $P(x,y)$ and derive the fluid velocity-components (u,v) at P .

3. State and prove the Kelvin's Theorem.

The velocity of fluid on a circle of radius a in cylindrical polar coordinates (r, θ, z) is given by $q = \left(2U \sin \theta + \frac{\kappa}{a} \right) e_\theta$, where U, a, κ are positive constants. Find the velocity-circulation of the fluid around the circle.