15

College of Engineering & Technology

Department: Mechanical Engineering Marks: 15
Lecturer: Dr. Rola Afify Time: 12:30 – 2:00
Course Code: ME416 Date: 15/12/2015

Name: R.N.:

Answer the following questions:

Question one (5 marks)

A steady two-dimensional flow field described by $\left|\vec{V}\right| = \sqrt{5y^2 + x^2 + 4xy}$ m/s with $xy + y^2 = k$ (streamlines), determine:

a) The velocity components.
b) The location of any stagnation point.
c) The acceleration vector.
d) The resultant acceleration, if it passes by point (1,2).

Question two (7 marks)

The three components of velocity are given by:

$u = x^2 + y^2 + z^2$, $v = xy + yz + z^2$, and $w = -3xz - \frac{z^2}{2} + 4$, determine:

1. The volumetric dilatation rate.
2. Is this incompressible fluid?
3. Is it satisfied the conservation of mass (continuity equation)?
4. Is it a physically possible flow field?
5. The rotation vectors.
6. The vorticity.
7. Is this an irrotational flow field?

Question three (3 marks)

The two components of velocity are given by:

$u = 4y$ & $v = 4x$, determine:

1. The rate of angular deformation (rate of shearing strain).
2. The stream function.
3. The velocity potential.